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Present Ordnance Problems

The Continuing Functions of Peace-Time Procurement Planning

By Maj. Gen. William H. Tschappat*

PEACE-TIME procurement planning is a vital element in preparedness for national defense. I say this without qualification. The success or failure of the Ordnance Department in war, and, of greater importance, the success or failure of the armed forces, will depend to a large extent upon the adequacy and soundness of our present-day industrial mobilization plans. Sound plans can result only through unceasing study and effort.

In my opinion, planning for the defense of the nation is today more vital and more to the point than at any time since the close of the World War. The world today is full of wars and alarms of war. The fundamental reason for this state of affairs is the desire, if not the necessity, of certain countries to improve their economic conditions by the acquisition of additional territory and the fixed intention of certain other countries to retain their possessions intact. While I do not believe that this condition will result in a war of world-wide extent in the immediate future, it is serious enough to warrant us in maintaining our plans in a status which will permit of their being put in effect on short notice.

As a people we have determined not to allow ourselves to become involved in another international conflict, and in adhering to that position I sincerely hope that we may be successful. However, it is not difficult to visualize ways by which we might be dragged into the next war. In fact our people might reach the point where they would demand our active participation. Witness the popular opposition to our entering the World War in 1916 and its enthusiastic reversal by the entire nation early in 1917.

As a direct result of this determination of the American people to stay out of future wars, numerous proposals to this end have been advanced in Congress and elsewhere. For the past year or so, much newspaper space has been devoted to "munitions makers", "war profits", "export of munitions", and the "nationalization of munitions manufacture." As these are matters having a decided bearing on our planning problem, I think it might be of interest to state the War Department's position on some of these current questions.

It is apparent that the present trend of policy of the American government is toward discouragement of the exportation of munitions of war, not alone to belligerents, but under all circumstances. The recent neutrality legislation requires the President to forbid the exportation of arms and ammunition to any port of a belligerent, or to any neutral port for transshipment to a belligerent. A permanent provision establishes a licensing system for the manufacture and export of implements of war under the supervision of the State Department.

THE War Department does not oppose the licensing of American industry in the manufacture of munitions, as it does not believe that control by licensing will in any way impair the efficiency of American industry for munitions manufacture in war.

The War Department is convinced that in the event of war, American industry must produce the major portion of the required munitions. Assuming this premise, it follows that so far as practicable industry should be prepared to perform its war mission. Therefore the War Department has consistently favored the participation of American industry in munitions manufacture and has encouraged the production of munitions, not only for the United States Government but also for export, where such export is not contrary to the policies of the State Department and does not divulge vital military secrets of design. This policy has been followed because it is believed that an organization or an industry that has produced munitions in peace will be better qualified thereafter to produce munitions in war.

For these very reasons, the War Department does not favor the nationalization of munitions manufacture; that is, the full manufacture in Government establishments. Such a policy would fail in war and therefore does not appear logical in peace.

Our existing manufacturing arsenals do have an important place in the scheme of industrial preparedness. In time of peace we look to them to assist in the development of new designs and the improvement of existing matériel. We depend upon them for production, at least sufficient to uncover production difficulties, standardize methods of manufacture, and determine costs. It is through these means that the art of manufacture of ordnance is kept alive. They serve as centers for the training of personnel in both peace and war, and provide a nucleus of trained personnel to assist in the inauguration of mass production. In the early months of war they will be an important source of manufacture of such urgently required matériel as they are capable of producing without material expansion of facilities. To permit our arsenals to undertake a large increase in production facilities after the outbreak of war would seriously interfere with these vital functions.

As to the matter of war profits, it is believed that present procurement plans will go far in preventing contractors from making excessive monetary gains. The fixing of price levels is a major element in eliminating such profits, but it is not the only element. Price-fixing alone cannot accomplish the desired result. It must be supplemented by reasonable and effective procedure in letting contracts, and also by excess-

*Chief of Ordnance, U. S. Army.

profits taxes. During a war, the enlarged requirements for war materials make it necessary to use the product of the high-cost producer as well as that of the low-cost producer. It therefore becomes necessary to set prices at a level which will make it possible for each producer to turn out his part of the nation's requirements without loss to himself. With such a price level, the low-cost producer is bound to make large profits. In a war emergency, business of all kinds is stimulated and excess profits may result in all branches of manufacturing in trade. In such an emergency the fairest method of preventing undue concentration of profits would seem to be the use of some form of excess-profit taxation.

AND now may I say a word about the status of our procurement-planning work, in which we have been engaged for a period of fifteen years or more. Prior to the depression, we laid the foundation for this planning through the method of trial and error. Planning was difficult during this period. Unusual industrial prosperity and world peace militated against rapid progress in our endeavor to comply with the 1920 mandate of Congress on industrial planning. The confusion and experiences of the World War were soon forgotten. However, despite these handicaps, it is gratifying to note the progress that has been made in this work.

During this period, we established the basic planning organization and we selected and trained the ordnance-district personnel. We determined our requirements in equipment, and we secured a reasonably accurate knowledge of the capacity of industry to meet these requirements. We developed many concrete plans for the conversion and construction of facilities where necessary to meet the war load. Today the period of trial and error has passed, and we now feel that we are in a position to crystalize our ideas and establish definite and sound policies.

But do not get the impression that planning has, or ever can, become static or a routine procedure. Procurement planning is a continuing task. Even if all facilities were surveyed, all factory plans developed, and all specifications drawn, we would still be faced with new designs of equipment, new inventions, new processes and methods of manufacture, and numerous other developments in the industrial world.

Again we must expect continued changes in requirements both as to types and quantities of equipment. It is the duty of our General Staff to see to it that our military forces are properly organized for modern combat and are provided with equipment which will best meet the changing requirements. It is the duty of the Ordnance Department to provide the means for procuring that equipment. Changes in design and revision of requirements are upsetting to the planner and add to the complexity of the problem, but I do not see how they can be avoided. Through the work of the General Staff, the Office of the Assistant Secretary of War, and the various Service Schools, all branches of the War Department now have well-defined boundaries limiting the duties which they are required to perform, and each has an understanding of the duties of all others. Even with the expansion of these branches brought about by war, it is believed that much of the overlapping and duplication of effort experienced in the last war will be avoided.

Here I would like to add a word of caution against too much detail in planning. By eliminating some of the mass of detail and concentrating on the broader aspects of the problem we avoid many of the difficulties involved in changing requirements. Some are prone to think that if requirements and design could be stabilized, plans might be prepared in such detail that everything could be started automatically by the mere pressing of a button. Even if changing requirements in peace time could be avoided, it is certain that changes will occur at the very beginning of war. For procurement-planning purposes we base our requirements on War Department plans contemplating the maximum effort of the nation in war. Of necessity such plans must cover all reasonably possible situations. When we do become involved in a war, we will then be facing a specific military situation and our actual requirements will be determined by the character and extent of that war. Without doubt, this will mean changes in quantities to be produced in the case of numerous items. The best that we can hope for is that these changes will not be too radical and that they will not result in a net increase in our war load. I am confident that the latter will not occur.

In conclusion, I feel that we have built a secure foundation and are well on our way toward the establishment of sound principles and policies. These policies, if correctly administered, will enable us to accomplish our mission in war planning. They have one common denominator—reliance on industrial planning.

In the obvious state of unrest throughout the world, efficient and dependable procurement plans are a rock of security.

International

THE ARMY'S NEW LIGHT TANK ON THE SAND-TEST COURSE AT ABERDEEN PROVING GROUND

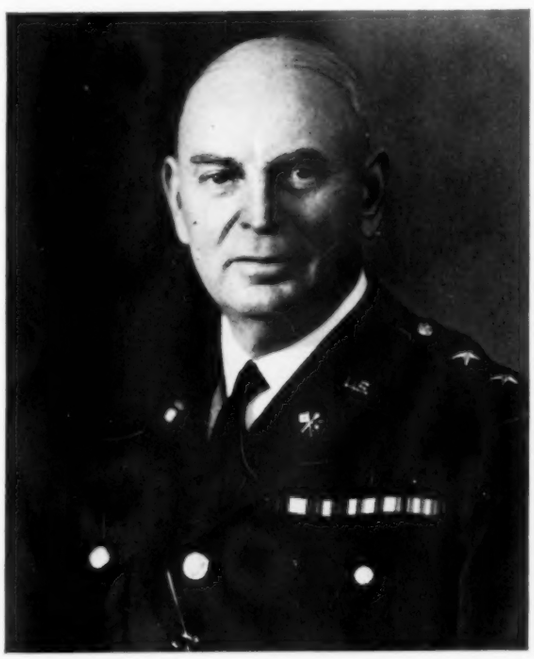
The Signal Corps in Action

Maintaining Communications in the Theater of Operations

By Maj. Gen. James B. Allison*

SIGNAL CORPS troops in the theater of operations in time of war will be engaged upon a number of different activities: telephone, telegraph, radio, message center, signal intelligence, meteorology, photography, testing and adaptation of signal equipment, supply of signal equipment, and breeding and training of homing pigeons—all these are part of Signal Corps responsibility.

The Corps is responsible for all signal communications within the theater of operations except those within the infantry, artillery, and cavalry brigades and within regiments or separate battalions of other branches and within Air Corps headquarters and air fields. Within these units the division signal officer exercises staff supervision only. Thus the job forward of brigade headquarters is a line organization function while that in rear of brigade headquarters is the responsibility of the Signal Corps. In addition to the responsibility of handling signal communications, the Signal Corps has the tasks of developing and supplying all signal equipment for the Army and of handling the meteorological and photographical services as well.



MAJ. GEN. JAMES B. ALLISON

In order to accomplish these missions the Signal Corps will have the following units in the theater of operations: 1. In each infantry division, a division signal company of 7 officers and 168 men. In each cavalry division, a division signal troop of 7 officers and 170 men. 2. In each infantry corps, a signal battalion of 17 officers and 471 men. In each cavalry corps, a signal troop of 6 officers and 163 men. 3. In each field army: a headquarters, army signal service of 23 officers, 153 men; two signal battalions with total of 34 officers, 942 men; a meteorological company of 5 officers, 71 men; a photographic company of 9 officers, 266 men; a radio intelligence company of 6 officers, 205 men; a pigeon company of 9 officers, 266 men. 4. In the GHQ Signal Service: a headquarters, GHQ signal service of 88 officers, 324 men; two operation companies with total of 14 officers, 436 men; three meteorological companies with total of 15 officers, 213 men; a radio intelligence company of 6 officers, 205 men; a construction battalion of 17 officers, 469 men.

It should perhaps be emphasized that these Signal Corps troops are charged with only about one-half of the signal communication work of the Army, the other half being divided among the several arms with the infantry and field artillery handling the major share. The Signal Corps portion of the communication system serves the larger headquarters. It operates over long distances and much of its equipment is so complex as to require expert skill for its operation. There is a progressively larger volume of traffic at successive headquarters to the rear: division, corps, army, GHQ. The regimental and brigade systems, on the other hand, operate over short distances, but equipment is still complex enough to require considerable training for its satisfactory operation even though each of these forward headquarters handles a relatively small volume of traffic.

There are in a field army more than 120 signal communication systems, each operated by a different unit. These must tie in with the systems of each of its neighboring units to form what is, in effect, one big communication system embracing the entire army. It should be practicable to secure connections quickly and to transmit messages between distant headquarters, utilizing the facilities of intermediate systems en route. However, in spite of the best efforts of signal officers, this coördination has always been difficult to accomplish at the beginning of maneuvers, though it has usually been improved with time and practice. Similar difficulties are anticipated in the theater of operation as the successive increments arrive. Entirely satisfactory communications cannot be expected until all communication units of all the arms have learned to work with their neighboring units as members of the signal communication team.

AMERICANS in their homes and in their businesses are the greatest users of the telephone in the world. We have more than 16 phones per 100 population whereas Germany and Great Britain have only about 5 and France about 3. The United States is served by the finest commercial telephone system in the world. It is only natural then that when Americans put on the uniform, they should demand more telephone service and faster connections than any other army. This statement applies to the regular officer in time of peace as well as to the emergency officer when he is called out.

It is the signal officer's job to meet the demand for telephone service but he must employ the minimum possible number of men who can accomplish the result. This calls for

*Chief Signal Officer, U. S. Army.

forethought, ingenuity, hard work, and common sense. When there are commercial lines in the theater of operations, the Army leases them. When there are poles or trees or buildings on which to fasten wire lines, they are utilized. When there are no poles or trees or buildings, twisted-pair wire is laid on the ground and reliance is placed on constant patrolling to repair the breaks and keep the lines working. As soon as time is available and sufficient men, transportation and material can be collected, these field lines are replaced by bare wire on poles. This is necessary for two reasons: first, too many men are required to maintain lines laid on the ground, and such lines are often out of order in spite of the best efforts of the linemen, and secondly, the limit of range of such lines is only about 15 or 20 miles (increased to 30 miles by use of loading coils). Therefore pole lines must be built as soon as practicable from the base of operations right up to the edge of the zone of heavy shelling.

MODERN WIRE-LAYING TRUCK AND CREW

In building pole lines, there are some officers who believe that the Army should follow Bell Telephone Company specifications and methods. The Bell Telephone Company is an admirably efficient organization. When it builds a pole line or pulls in a cable, that line or that cable is put in just right. The circuits will be excellent and the system will require the minimum maintenance for years to come. But there are others who, while admiring Bell Telephone results, point out that time is often too short to build for permanency. They believe that speed is too important to attempt heavy construction and that the aim should be to build lines which are just good enough to serve their purpose, but to build them fast and to use the minimum men, transportation and material to do so.

Both systems will have their uses in the theater of operations; light, improvised construction will be used when speed is essential and the number of circuits is small, while standard construction will be demanded when the number of circuits is large and also when time is available to build more slowly and thus minimize future maintenance troubles.

At the Pine Camp maneuvers last summer, the 51st Signal Battalion put in excellent pole-line construction for the forward areas. The Army Signal Officer had secured permission from the local telephone and power companies and in the maneuvers he fastened his cross arms to their poles. When he had to put in poles himself he used 20-foot ones weighing only about 150 pounds each—light enough to be set by one man. Construction methods were similar to those used by commercial companies for their light pole lines. The circuits were excellent and would have been satisfactory up to distances of sixty miles.

The construction company of a well-trained signal battalion operating under the most favorable conditions will be able to build about eight miles of light pole line per day. It is recognized, however, that conditions will seldom be entirely favorable, that poles may not be available in the area, or that the tactical situation may demand lines at a faster rate than eight miles per battalion per day. In other words, the demands that may be made upon the company are subject entirely to the requirements of a given situation; at times these demands may be greater and at times less than the organization is equipped to meet. The signal battalion is therefore prepared to lay field wire on the ground at a very rapid rate, utilizing a new type of wire-laying device which handles two one-mile spools of twisted-pair wire simultaneously and which, together with six miles of wire, is carried by a half-track commercial truck. When recovering wire, a small gasoline engine turns the spools and recovery is as fast as the men can place the wire in the clear and remove the tangles. There are other lighter types of wire-laying devices which are carried by man power over such routes as are impracticable for wheeled transportation to negotiate.

IN rear of corps headquarters the telegraph becomes the principal means of rapid communication. An important change has taken place in telegraph operation since 1918. At the time of the World War, the printer telegraph was in commercial use and multiplex printers were employed to a considerable extent in the A.E.F., although manually operated Morse instruments still handled the bulk of traffic. Since 1918, however, the printer telegraph has been steadily replacing manual Morse in the commercial field until now there are scarcely any young Morse operators left. For two reasons, therefore, the Army has also changed from manual to printer operation: first, because it desired to increase speed, efficiency, and economy of trained personnel, and secondly, because in our mobilization of man power complete absence of Morse operators is to be expected. In the theater of operations, therefore, we will have the printer telegraph at GHQ, army, corps, probably division, and possibly forward to regimental headquarters.

A new printer-telegraph machine weighing only thirty pounds has been developed at the Signal Corps laboratories. This machine will be service-tested within the next year, not only for operation over good overhead and cable circuits which heretofore have been considered normal circuits for the printer telegraph, but also for operation over field wire lines. If operation of this light machine over field wire circuits proves reliable, it may be found practicable to use it as far forward as the regimental CP.

Meanwhile we have for the forward areas a very light and compact set which employs a tone signal similar to that of a radio-telegraph set. After wire lines are laid and as long as

they remain operative there will be little need for radio. The radio operators may therefore operate their radio sets when the CP is first established. Then, after wire lines have been installed, they may close their radio stations, leaving them ready for emergency use, connect in their telegraph instruments and operate these as long as the wire lines remain in service. When the wire lines are shot out they will again turn to radio for normal operation.

RADIO has a strong appeal to the popular imagination, military as well as civilian, so much so that the Army is well equipped with radio sets and continues to develop new ones in an effort to keep abreast of the rapid developments in the art. There are those who, having given careful thought to the problem, are convinced that the Army is overequipped with radio. There are others who would open the door wide to the use of radio in our peace-time Army. These latter look upon such use as no more than an adequate service test to determine what radio the Army should have and how that radio should be used. They also point out that radio continues to develop so fast as to prohibit the accumulation of a satisfactory war reserve and that any sets which could be spared by the Regular Army and National Guard on M-day and loaned to inactive units being mobilized, would be the sole modern field radio equipment initially available to those units.

A FIELD METEOROLOGICAL STATION

My natural inclination is toward the liberal point of view because I feel that the full possibilities of radio can be determined only by following all promising developments. The results achieved by such a policy in the past seem to have fully justified the comparatively modest expense of our development program. In this respect I am mindful of the calculations of the eminent physicists after Marconi's early experiments and while he was sending and receiving signals across the Atlantic. They proved mathematically that it would be impossible to propagate radio waves for more than 160 miles!

Radio is the principal means of communication between elements in the air, between air and ground, and between mechanized and cavalry forces. With infantry, artillery, and other troops which move more slowly, telephone, telegraph, and messenger are the primary means, and radio merely an auxiliary or contingent method.

The advantages of radio are so obvious that they require slight, if any, mention. But to Americans whose contact with radio may have been chiefly through program broadcast, it may not be amiss to mention its disadvantages. Your broadcast station is housed in a substantial building and remains dry and at an even temperature. The equipment is firmly installed and remains in its carefully engineered place. It has a reliable source of power by simply throwing a switch. The station possesses expensive and delicate testing equipment, and since its retention of license depends upon operating exactly as licensed, it employs engineers at good salaries to keep it so operating. Army radio operates under different circumstances. It must be light enough to be portable; it must take hard knocks, rain, changes in temperature, sometimes mistreatment. It is not surprising then that Army sets sometime drift off their assigned frequencies and interfere on other channels. In addition to this accidental interference we may have atmospheric or static interference. In the Southwest, for example, this sometimes becomes very troublesome, and there are certain hours during the heat of the day when it is difficult to handle traffic. Static is also bad for radio reception when a thunderstorm is near.

Then too, the enemy may interfere. At the Signal Corps School maneuvers last June three sets were detailed to get out back of the enemy's front line and see what they could do in the way of interfering with the students' radio system.

These "enemy" interferers were surprisingly active and we learned something about the possibilities of such operations. This is a problem which is going to be hard to solve. Of course, two can play at that game, and if the enemy interferes with us, we can also interfere with him. Moreover, when the enemy is interfering with us he is at the same time blocking his own radio circuits. We get some consolation from such reasoning, but it will be empty consolation if, when we need radio badly, we cannot use it.

Perhaps the most serious disadvantage of radio is the fact that the enemy can easily intercept our transmissions. This forces us to put almost everything into code and this in turn greatly delays the handling of messages and also gives two opportunities for errors, one when encoding and another when decoding. He can also, by means of his goniometric service locate our radio stations with considerable accuracy. In this radio problem we are between Scylla and Charybdis. Realizing the tremendous value of radio for mobile forces, we would be guilty of criminal negligence should we fail to use it. Yet we do not dare place sole reliance upon it because we fully appreciate its weaknesses.

THE message center was born to the American Army in the A.E.F. It flourished in stabilized warfare; it was pampered; it grew to large size, became a spoiled brat, demanded excessive attention and received it. Before the war was over its elaborate procedure had become so traditionally a part of headquarters operation that cold analysis of its basic virtue and of its superfluous processes was sacrilege.

In the tumult of battle, with wire lines destroyed, messenger routes all but impassable, nerves on edge and bodies

on the verge of exhaustion, it was inevitable that some messages should be delayed and others lost. It was natural that such accidents should be always annoying and sometimes maddening. And it was natural that the man who had once felt the wrath of his chief for his actual or alleged negligence, should seek to protect himself in the future by demanding a receipt for every scrap of a message which passed through his hands and that he should keep a book to record those receipts and the circumstances connected therewith. In all fairness, we should recognize the case for the message center.

A Field Radio Set in Operation

Yet rapid transmission of messages is essential, and the message center must not be allowed to delay them. Recognizing this problem in the 1934 Command Post Exercises in New Jersey and in the 1935 First Army Maneuvers in the Pine Camp area, I caused a detailed study to be made of the message center. As a result, a new and greatly simplified procedure was scheduled to be tested in the Second Army Maneuvers and in the Third Army Command Post Exercises during the summer of 1936. I am very hopeful that this problem is on the way toward solution.

Signal intelligence is the term we use for operations designed to learn by means of the enemy's transmissions all we can of his organization, operations, and intentions and in turn to conceal such information of our forces from him. The signal intelligence service prepares and distributes our codes and ciphers and attempts to solve those of the enemy. It intercepts his radio messages and tries to get information from them. It also intercepts messages from our own stations in order to correct possible indiscretions in our own transmissions. And it operates radio goniometric stations in order to locate hostile stations and from these locations to assist G-2 in deducing the hostile organization and disposition.

The Signal Corps acquired its meteorological responsibilities when the national weather service was organized in 1870 because at that time there were no commercial wire lines connecting many points in the West from which observations were desired. The Signal Corps had to put in the lines; it might as well take the observations. So in the early days before there was a Weather Bureau, the Signal Corps operated the nation's weather service. At one time the Corps operated 224 observation stations, each making eight reports a day. This system utilized over 5000 miles of telegraph line constructed and maintained by Signal Corps personnel.

It was the Government's policy to dispose of military lines as soon as a commercial company was ready to furnish service, so that gradually, as the West built up, the military lines shrank until in 1890 the Weather Bureau was organized under the Department of Agriculture. Since then the Signal Corps has been responsible only for military meteorology. The branches chiefly interested in weather data are: Field and Coast Artillery for firing data; Chemical Warfare Service for conditions affecting the use of gas; Air Corps for flying conditions; and all commanders and staffs for weather forecasts.

A few small field meteorological stations are organized in an army area. The army meteorological officer receives data from the Weather Bureau, and with the addition of observations from his own stations, makes his own forecasts for the army area. The demands for meteorological service have greatly increased in the last few years due to the expansion of Air Corps activities, to the longer ranges of modern artillery, and to the developments in sound ranging, that is, locating the "hits" of friendly artillery and the position of hostile artillery.

THE Signal Corps acquired photography by accident. The War Department library was placed under the Chief Signal Officer in 1894 apparently because General Greely was a handy and suitable man for the task. It happened that the Brady collection of Civil War pictures was transferred to the library soon afterward, and the Signal Corps became so much the photographic branch that when the General Staff was organized and ready to take over the library, it was decided to leave photography with the Signal Corps. We have had it ever since.

The activities of the photographic service may be divided into four classes: 1. Pictorial publicity through which we offer newsworthy pictures to newspapers and magazines. 2. Historical, still pictures, which appear in almost every book and article on the war. 3. Historical motion pictures, of which we have valuable files of the World War. 4. Sound moving-picture training films, of which we complete about four per year and plan to make hundreds more upon mobilization. The photographic service is a small one—one officer and two men per division with a small group to operate the Army Photographic Laboratory and to handle the supply of photographic equipment.

Modern warfare is not solely a strategical, tactical, and logistical operation. It is also an engineering operation in which every branch of scientific research must be utilized to bring about the defeat of the enemy. In no branch of the service is up-to-date technical knowledge more necessary than in the Signal Corps. We are proud of our research and development organization, and we believe we have better signal-communication equipment than any other army.

In time of emergency the principal development activities will undoubtedly remain in the zone of the interior, and probably at present localities—Wright Field, Ohio, for signal equipment for the air, and Fort Monmouth, N. J., for other signal equipment. If, however, the theater of operations should be outside the United States, it would be desirable to

establish a research and inspection laboratory in the theater of operations. The functions of the laboratory would be: collection of information on enemy signaling equipment; dissemination of this information so that our troops may be able to use captured equipment; first-hand observation of the functioning of our equipment, and development of improvements or of new apparatus which may be better suited to battle conditions; and inspection of signal equipment arriving in the theater of operations.

BY weight, the Signal supply problem is a tiny one when compared to those of the Ordnance and Quartermaster Corps. A type field army requires about sixty-six tons of Signal supplies per day or a little more than two freight-car loads, this, of course, being exclusive of poles and other project material. Our supply problem is a small one by weight, but it is difficult because of the special and complex nature of military signal equipment. This difficulty will be the problem of the zone of the interior. In the theater of operations the problem, being chiefly one of distribution, is not expected to give much trouble.

Signal supplies will follow the general rule of echelonment in depth in the theater of operations. There will be a signal section in each general depot in the base section of the communications zone, and in case the theater of operations is extensive enough to require such distribution, there will be one or more signal depots in the intermediate section and also in the advance section. The possible size of these signal depots may be pictured by considering that the A.E.F. Signal Depot at Gievres employed 20 officers and 425 men and handled about 18 cars per day, while the advanced Signal Depot at Is sur Tille employed 15 officers, 250 men and handled about 13 cars per day.

In general, no fixed Signal supply establishments are located in the combat zone. As soon as circumstances permit, small supplies of the principal items will be collected at the army signal depot, at the corps signal park and at the division signal dump. There is no transportation allotted in tables of organization for the division, corps, or army for transporting reserve signal supplies. Therefore items initially available in these temporary supply points will be very limited in variety and in quantity. It is intended that these points shall not build up reserve supplies beyond the capacity of the vehicles of signal troops of their respective units. It is estimated that when signal troops enter an engagement, they should have immediately available on their own transportation, sufficient wire and batteries to last for about four days of operations. Tables of allowances are based on this assumption, and as signal troops ordinarily reach an assembly area with the advance party and begin the installation of the signal system at once, it is apparent that the flow of signal equipment and material from the communication zone must begin prior to the completion of the concentration.

ARMY pigeoneers and their birds are so unobtrusive and their lofts so few that some members of the Army do not realize that the Army still has pigeons. It seems an anachronism in the days of the long-distance telephone, high-speed radio, and multiplex telegraph, to utilize a means of transmission which was already ancient when the Crusaders invaded Palestine. The World War, however, turned back many pages of history. The page of the homing pigeon remained turned, because pigeons proved themselves reliable and rapid; in many instances, as in that of the "Lost Battalion", they got messages through when all other means had failed.* Pigeons proved themselves so convincingly that the armies of the great powers continued their war-time pigeon services.

The Signal Corps policy is to rely on the thousands of patriotic pigeon fanciers of the country to supply the large numbers of birds which will be needed in an emergency, but meanwhile it conducts training and experiments in order that

PIGEONS BEING RELEASED FOR A PRACTICE FLIGHT

it may be kept informed of the possibilities of using pigeons for various situations. A few Army lofts are thus required and in these lofts the Signal Corps aims to develop a superior strain of pigeon. That it has succeeded in doing so is evidenced by the record of its entries in the big races which are held each year.

Pigeons require about a week to settle to a new locality. After this period when taken to a distant point and released, the pigeon returns to his loft at a speed of about forty miles per hour. Our plans contemplate the use of pigeons in considerable numbers, lofts to be attached to corps headquarters for particular operations.

The Signal Corps finds itself fully occupied with these varied duties and responsibilities. Anyone engaged in communication work in these days of rapid development finds that he must keep on his toes to stay abreast of the times but those who do so find it absorbingly interesting.

*EDITOR'S NOTE—The following, from "America's Munitions", is of interest in this connection: "Although nearly every European army for forty years has trained the carrier pigeon to be a field messenger, the American Army never adopted the bird until 1917. In a single year the Signal Corps established hundreds of pigeon lofts in this country and overseas and bought and trained more than 15,000 pigeons for service in France. In actual use on the field, the pigeons delivered more than ninety-five per cent of the messages intrusted to them, flying safely through the heaviest shell and gas barrages."—*America's Munitions. By Benedict Crowell.*

What Price Automatic?

Comments on the Development of A New Arm, I

By Melvin M. Johnson, Jr.*

A COMPLETE SURVEY of the development of the semiautomatic rifle and the light-weight machine gun would demand a large book. In this age of specialists few men can devote much time to matters not directly connected with their more immediate work. Ordnance covers a wide range of scientific subjects, and most of the readers are experts in specific fields. It is submitted, however, that those who are studying military science and those who are interested in small arms, should appreciate the semiautomatic or self-loading firearm. Moreover, those who are specialists may be interested in the tribulations of their fellow sufferers. Addressed, therefore, to the readers of ARMY ORDNANCE, this article is nevertheless dedicated to that legion of indomitable strugglers whose shattered hopes and lost causes are published in the United States Patent Office at ten cents per copy: the inventors of unsuccessful self-loading military rifles.

When we consider the multitude of mechanical military triumphs within the past four decades, we naturally are surprised at the tardy arrival of the service automatic. In previous articles in this periodical, such eminent authorities as Lieut. Col. Julian Hatcher and others, have discussed the operation and design of all well-known automatic weapons. Their approach has been historical; ours will be analytical. We shall not be technical; we shall be idealistic. We shall not necessarily narrate what others have done. Instead let us suppose that you, the reader, and I, the author, have been assigned a specific task—the design of a simple, durable, rugged, reliable, understandable, military self-loading rifle, which shall weigh no more than a Springfield, use Mark I ammunition, contain few parts, require simple manufacturing operations, and function perfectly under all conditions in the hands of any rear-rank private.

Before beginning this analysis, the writer wishes to state that no criticism of any inventor or invention, whether official or private, is intended, despite the fact that I shall freely and honestly express personal opinions in this discussion. Furthermore, I wish to point out one important fact: no invention is really a failure; because from the experimentation therein involved we all learn something more about the art which may be of immense value in our own work, even though it merely saves our time. There are many ways of skinning the cat, some good and some not. An inventor proves that a certain method is unsatisfactory, and his successors profit by the knowledge of "what not to do" thus imparted. Those who do achieve success are not legally or morally obligated to their unsuccessful predecessors on the above grounds; nevertheless, they should render tribute even to a negative contribution.

What must our rifle mechanism do? The process seems simple enough. When the bullet has departed from the barrel, and the residual gas pressure has dropped to a safe limit, the breechblock must automatically disengage from the breech and move to the rear of the frame or receiver, thereby extracting and causing to be ejected the empty shell case. A conventional mainspring having been compressed by this operation, the breechblock is then returned, loading a fresh cartridge from a conventional magazine, and locking the breech. Moreover, by these operations, or one of them, the hammer or striker is cocked.

IF we were considering a machine gun, the task would be simpler because we would not require a semiautomatic type of trigger mechanism. The forward movement of the breechblock could be utilized to fire the cartridge at the proper time; the sear would merely hold the breechblock in the open position. Stripped of belt-feed mechanisms, cooling apparatus, etc., the machine gun is a "kid brother" to the semiautomatic and much easier to build, as we shall eventually see.

Primarily, then, our task is complete when we have caused the empty case to be thrown from the gun, and compressed an adequate mainspring. We need not immediately consider the conventional magazine, ejector, barrel, safety, stock, sights, tripod, belt feed, or cooling system, except in so far as provision must be made for these parts in conventional places on a finished arm.

However, we must not overlook secondary requirements. The production department, for example, will demand a weapon which can be manufactured cheaply within a reasonable time, with reasonable machine operations, without split-hair adjustments. The ammunition department will demand a mechanism which can accept the standard service ammunition. Above all, the using arms demand a conventional-handling rifle, not a mechanical monstrosity. The tool was never made for the infantry that a recruit could not put out of order without taxing his destructive ingenuity a particle.

We have already been assigned our task or objective. We understand that our rifle or machine gun must be practical to build for experiment, economical to manufacture in production, and certain to function in combat. Our basic principle is *simplicity,* which, paradoxically, is most difficult to apply. That fact has been recognized by the Supreme Court of the United States in patent opinions which affirm that "simplicity is the highest state of the art". Therefore, we must adhere strictly to a simplified system in our automatic. Many ingenious contraptions have failed miserably for violation of simplicity.

Automatic weapons can be actuated, basically, by the employment of a gas cylinder, or by a retarded blowback method, or by the long or the short recoil system. We must accommodate high-powered ammunition such as the caliber .30 Mark I. We are not discussing such "freaks" as "blow-forwards", "blowdowns", "recoil-forwards", "primer-setbacks", and others. for reasons set forth above. Two forces, or applications of the same force, are requisite: 1. The breechblock must be unlocked by some force set in motion by the explosion of the cartridge, which force must not pro-

*Associate Lecturer, Boston University Law School; member Massachusetts Bar; contributor to national defense journals. First Lieutenant, U. S. Marine Corps Reserve.

duce complete unlocking until the bullet has left the barrel, and the residual pressure has dropped to a safe limit. 2. The breechblock must be retracted by some force originated in the explosion, which force shall not act upon the breechblock until unlocking has been completed.

It is obvious that the explosion of the cartridge produces certain basic forces. Fundamentally, there are three: 1. The breechblock, which is employed to keep the shell from blowing back to the rear, receives an impact from the head or base of the shell. This blow is more accurately described as a violent push, because upon ignition, the powder gas begins to build up from zero a pressure which rapidly reaches 50,000 plus or minus pounds per square inch, using the caliber .30 Mark I load. But for the obvious fact that the breech cannot safely be opened at once, this force on the block would be a direct solution. 2. The above force causes the breechblock (or bolt if you are Springfield-minded) to "want to go rearward". The block is locked to the whole gun. Therefore, the gun "kicks". If the barrel and breechblock are slidably mounted in the frame or receiver, then the "kick" or recoil may be utilized in some manner. Thus, we have, in effect, two aspects of the same force. 3. Expanding powder gas pushes the bullet through the tube, while forcing backward on the breechblock as described above. By putting a hole at some point along the barrel, gas may be taken into a cylinder underneath. A piston in the cylinder, acted upon by the diverted gas, can be used in the conventional "engine" fashion.

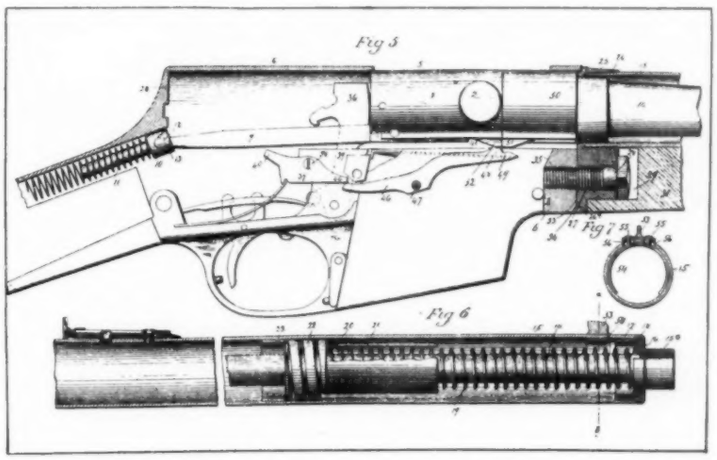


FIG. 1. RECOIL-OPERATED FIREARM AS PATENTED BY JOHN M. BROWNING, JUNE 3, 1902 (NO. 701,288)

The explosion, therefore, provides these forces in a normal weapon. By attaching various "gadgets" we might develop other movements, but to do so would violate simplicity. Our objective is to harness the explosion by adding a minimum number of "automatic" parts to the conventional rifle. Bear that point in mind throughout this discussion. Moreover, it is submitted that one large or complicated part is less desirable than two or three very small or simple parts.

WHAT SHALL we try first? With plenty of gas available, the use of a gas cylinder and piston is logical. The gun can be made on "engine" principles. By this method the movement of the piston will unlock the breechblock and retract it. Or we might use the piston to unlock the breech and then use the residual pressure in the chamber to retract the block.

Where shall the gas port or ports be located? Powder gases are not beneficial to a rifle barrel; they are even less so to a cylinder. If the port is near the breech there is less "carbon" because the flame is hotter. But if located aft, then we must figure out a mechanical method of delaying the unlocking of the breech. That is exceedingly impractical in my estimation. Of course it can be done, but that is not sufficient to accomplish our objective. If we put the port at or near the muzzle we have more "carbon". The cylinder must be long enough to reach the port. Therefore, an elongated gas tube must be machined, as well as a piston and a connecting rod. Moreover, foreign matter, aside from "carbon", may clog a port so located. The cylinder must be strong and durable, otherwise a dent will prevent operation. The size of the port must be carefully determined or the gas force will be too great. A weapon of this type must be cleaned faithfully. It has inherent disadvantages in the field. The best gas-actuated weapon in the world will still have one basic defect: the fact that it is a gas-actuated weapon. A gas cylinder and a piston are only two parts, to be sure, but in production they are as difficult as four or five small ones.

Space, and other factors prohibit a further discussion of gas actuation. Later comparisons will be made in other connections. Remember that we are attempting to discuss the subject from an idealistic standpoint. It is submitted that a "gas gun" will not be the ultimate solution to our problem, though some "gas guns" may be better, point for point, than any other type so far developed.

The blowback method is worth our careful consideration. There we have the most fundamental force. The breechblock "wants to open up". However, we must delay the opening. Moreover, we must complete the unlocking movement in time to utilize the residual gas pressure in the chamber for retraction of the breechblock. The problem of timing, therefore, is more acute with this type than with the average gas-actuated system wherein the piston performs both tasks.

Bear in mind that the weapon must accommodate high-powered military cartridges, such as the caliber .30 Mark I. With the caliber .22 long rifle load we could use a breechblock having sufficient weight to delay the unlocking by its inertia. For a caliber .30 service load, the block would have to weigh twenty-seven odd pounds.

SEVERAL methods have been devised to retard the unlocking of the block or bolt mechanically. The most appealing point in such a system is the consolidation of the "automatic" parts in the breech. However, there is one serious difficulty. The conventional cartridge case does not lend itself to such a system unless adaquate lubrication is provided, such as grease or wax or oil on the cases or in the chamber. Thus, the Schwarzlose machine gun has an automatic oil pump; the caliber .30 Thompson rifle (not the caliber .45 T.S.-M.G.) had oil pads in the magazine, and special "wax" was needed on the cases designed to be used in the Pedersen rifle.

If we use a rotating bolt, having its lugs and locking abutments beveled at the proper pitch, the bolt will automatically unlock upon firing, and can be made to do so on time for retraction. That is the so-called "Blish screw-breech" principle, and was used in the Thompson semiautomatic rifle. There is some diversity of opinion as to the proper description of the Blish principle. However, I am a pragmatist, and I submit that the head of the bolt begins to give way before the pressure has subsided sufficiently. The result is that the case, unless lubricated, splits, or the primer "pops". The average military cartridge case demands a fixed support until the pressure has dropped below 15,000-odd pounds per square inch. If during the interval of higher pressure the head of the bolt or block gives way while unlocking, more than a few thousandths of an inch, the case will rupture. Movement of the head away from the shell during lower pressure causes the primer to be unsupported at a crucial moment. Therefore, the primer will "pop", even though the case does not rupture.

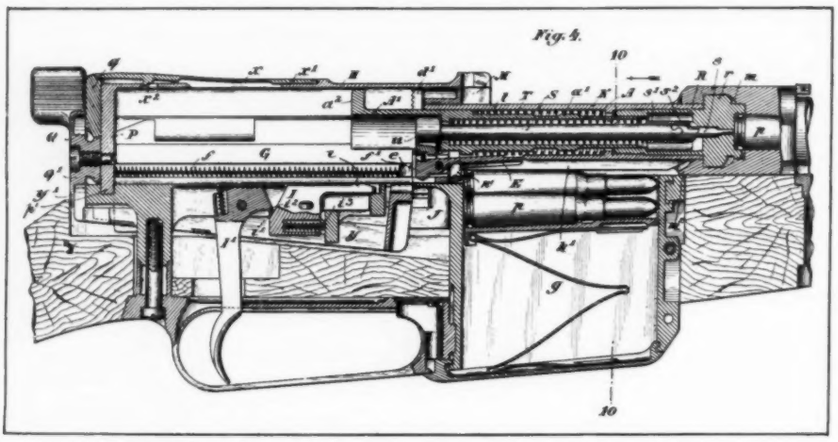


FIG. 2. THE MAUSER INVENTION OF 1905*. THE CLOSED POSITION

Why should the average service case rupture under such circumstances? Why does it not move back "all together" in the chamber? The neck and shoulders of the brass case are turned out thinner than the rear portion of the body of the shell. As the powder is ignited, the pressure swells the case to the chamber walls, pushes the bullet through the tube, and pushes rearward against the bolt or breechblock. The thin brass neck serves to seal the chamber from gas leakage, in the manner of a gasket on an engine. Therefore, the forward portion of the shell "refuses" to move back. But the thicker portion or base of the case does not adhere so tightly to the chamber. Therefore, unless this base is supported, it gives way. The case can not stand more than ten or fifteen thousandths "stretch" without rupturing. This rupture occurs, usually, about one-half inch from the extracting cannelure.

As the pressure drops, the entire shell adheres to the walls sufficiently to resist rearward movement without rupture. At such times, however, the removal of support from the base of the shell, allows the primer to be blown out by the remaining pressure. I have seen primers stand around 15,000 pounds per square inch, rarely more. If lubricant is applied to the case, this "wall friction" is reduced, allowing the case to move without any difficulty in the chamber.

Mechanisms, such as the Pedersen and Thompson, designed to make this "blowback" force work at a mechanical disadvantage during the interval of critical pressure, inevitably encounter the aforesaid rupture of cases, unless lubrication is provided. With the conventional cartridge, only the "rearward" force is available for unlocking power. Hence some movement rearward must take place during the unlocking interval. If we were able to store up the force of the explosion against the breechblock or bolt, or to transmit it to a separate part outside of the chamber, we might avoid the rupturing which occurs with a direct application of that force. However, such a method is exceedingly dubious.

INDIRECT methods, whereby the force of the explosion is transmitted to an actuating member, do not furnish sufficient power, unless the head of the bolt or breechblock moves an appreciable distance. Lubrication is required for such a movement.

I venture to predict that with conventional military rifle cartridges, no retarded-blowback system can ever be devised without making provision for adequate lubrication. Moreover, we must remember that dirt and grit in the chamber might overcome the effect of our lubricant in the field. If we used "unfixed" ammunition, this movement would be quite unobjectionable. However, unfixed ammunition would hardly be practical in conjunction with automatic small arms.

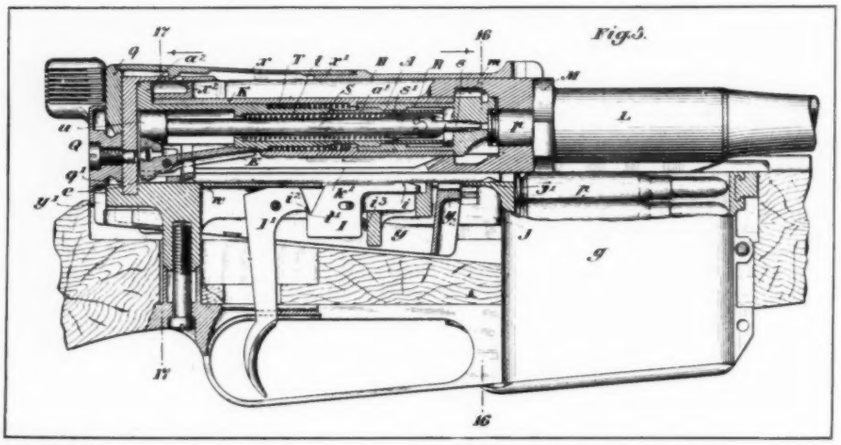


FIG. 3. THE MAUSER INVENTION OF 1905. POSITION AT END OF RECOIL

*This drawing and those shown in Figs. 3, 4, and 5 are taken from U. S. Patent No. 783,123, by P. Mauser, February 21, 1905.

The following point is submitted as a matter of academic interest. Where the movement of the shell case, under pressure, is used to impart a movement to an actuating member, it will be found that the "war-time" caliber .30, 1906 loads require about half as much movement to produce the required force as do caliber .30 Mark I loads. Mr. John Garand experienced this difficulty in his "primer-actuated" rifle. There the .30-06 primer was permitted to set back about thirty-thousandths of one inch, which movement drove his actuator rearward, thus producing a delayed unlocking of the breechblock. But so much more "setback" of the primer was required in this weapon when fired with the then new Mark I loads, that Mr. Garand decided to devote his skill to another type of actuation. The above phenomenon is attributed to the progressive burning of the improved rifle powders with which the Mark I ammunition is loaded. Manifestly, a successful military semiautomatic must operate with the powders in current use. In fact, it should operate without much adjustment for any type of load.

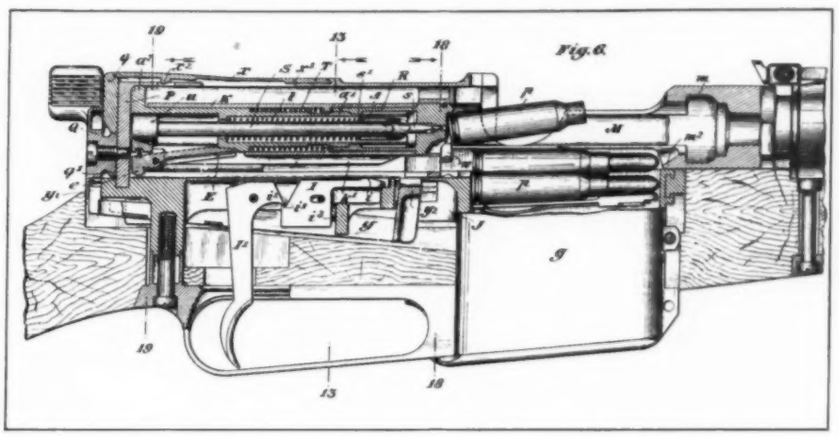


FIG. 4. THE MAUSER INVENTION OF 1905. THE BARREL HAS MOVED FORWARD

The reader may recall that earlier in our discussion the "blow" on the breechblock was described as a "violent push". The tendency to "push" is more marked in the action of Mark I powder. If these remarks arouse the ire of a powder specialist, apology is tendered by the writer, with the qualification that I can prove the above-described effect of different powders if necessary.

In this connection we can now dispose of those systems in which the blow or push of the explosion is transmitted to an actuating member. *Prima facie,* such a scheme seems to have possibilities for utilization in designing semiautomatics.

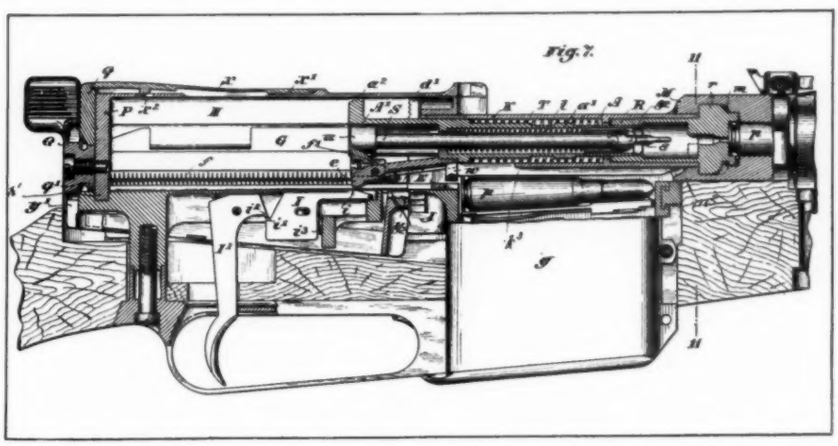


FIG. 5. THE MAUSER INVENTION OF 1905. THE GUN HAS BEEN RELOADED

Suppose you place a croquet ball under your foot, place a second ball in contact with the first, and then strike with your mallet the ball which is under your foot. The impact, transmitted through the first ball, causes the second—not struck by the mallet itself—to move across the croquet ground.

Why not use the bolthead or face for the first ball, an actuator or "inertia member" for the second, and the explosion or thrust of the shell for the mallet? Would the actuating member move with enough force to unlock the breechblock or bolt? Or suppose you assume that the explosion is the muscle of your good right arm, the bolthead the mallet, a fixed or slightly movable block the first ball, and an actuating member, in contact with that, the second ball.

Roughly, the explosion produces a blow of about 6500 pounds. It would seem that so much force ought to make the actuating member go back violently, so as to perform all of the necessary work. Alas, such is not the result.

To produce the above effect the shell and bolthead must be allowed to move an appreciable distance under pressure. The conventional case will not do that without a rupture, which we have discussed above. If the case did not rupture, wall friction would retard the movement of the case and the effect of the "push" would be lost. To conclude: 1. The explosion is merely a "push", not a sharp blow. 2. The normal friction of the case, unless lubricated, contributes to the reduction of actuating power. 3. Even if the shell is lubricated, there is not enough force to retract the bolt without the aid of residual gas pressure. 4. If a rotating bolt is used, the lugs must be beveled slightly to facilitate rotation under high pressure.

A RECOILING-BARREL system is perhaps the most obvious of all. The reader will recall the original Maxim machine gun which was patented back in the "gay nineties".[1] The force which produces lame shoulders on recruits can be utilized to actuate the mechanism of an automatic.

1. The following is quoted from U. S. Patent No. 430,210, Automatic Gun, Hiram S. Maxim, inventor: "What I claim is: 1. In a machine gun, the combination, with stationary supports or guides, of a barrel and breech mechanism fitted to and adapted to slide back and forth in said supports, a crankshaft and a crank connected with the breechblock, and a fixed point of resistance for engaging with a projection on the crankshaft for partially turning the same when the barrel recoils, and thereby retracting the breechblock, as and for the purpose set forth."

As stated at the beginning of our discussion, there are two classes: the long recoil and the short recoil. As our survey is not historical, I shall not describe each invention by name. Instead, we shall first analyze the long-recoil system.

Suppose we take a barrel and mount it "slidably" on a frame. We lock our breechblock to the barrel. When we fire the gun, the barrel and breechblock recoil to the rear of the frame. There the barrel and breechblock are caused to separate by some means, whereupon a barrel-spring causes the barrel to move forward while the breechblock is held at the rear of the frame. Thus the empty case is removed from the chamber. Then the breechblock is returned by its spring, loading and locking the piece.

Substantially the above system is used in the Browning autoloading shotgun, Remington autoloading rifle and shotgun (Browning patent) and the famous Chauchat or "machine rifle" used by the French during the World War.[2] Paul Mauser, the inventor of the Mauser and 1903 Springfield rifle, took out several patents on the long-recoil system as early as 1900.[3]

The worst criticisms of this system are the length of barrel recoil, and the number of tricky parts. The barrel movement requires a "brake" system. Two return springs are necessary. The locking system is complicated and not particularly rugged. Provision for the barrel movement necessitates a tube around the rifle barrel, and this tube retains heat excessively. Of course the movement of the barrel takes care of the unlocking and retracting of the breechblock. Using Mark I cartridges, the recoil distance must be increased an undesirable amount, usually over four inches.

Semiautomatic rifles of the long-recoil type have been consistently rejected for military use on the above and other grounds. If the barrel is movable to the extent of more than one-half inch, the weapon will require a complicated receiver or mount, and is quite likely to prove undesirable. Moreover, such faults would disqualify the invention as a satisfactory solution to our problem of designing the ideal semiautomatic military rifle and light machine gun.

Next on our list is the short-recoil type of actuation. Again we mount the barrel "slidably" in the frame. The breechblock is locked to the barrel. When the piece is fired, the bolt and barrel recoil together for a short distance, during which interval the bullet leaves the muzzle and the residual gas pressure drops to a safe point. The breechblock is thereupon unlocked, and the residual gas pressure thrusts the breechblock to the rear of the receiver, thus causing the shell to be extracted and ejected. The unlocking of the breechblock is effected in some manner by the force of the recoiling parts.

The above system is employed in the Colt automatic pistol (Browning patent), in the Browning machine gun, and the Maxim gun. However, on the Browning machine gun there are a number of special parts, such as the "accelerator" which allows the moving barrel to impart an extra momentum to the breechblock.

The barrels on the Browning and Maxim machine guns move about five-eighths of one inch. This movement allows time for the pressure to drop. Due to the weight of the breechblocks in these guns, it is the writer's opinion that recoil-momentum is a factor in their retraction, as well as the force of the residual gas pressure.

Numerous Browning recoil-rifle patents were taken out after the war, but it appears that this famous arms expert, who was so eminently successful with his pistols, machine guns, and shotguns, never succeeded in developing a satisfactory military shoulder rifle. I except, of course, the Browning automatic rifle, gas-actuated, which weighs over fifteen pounds.

This question is often asked: if we have a service pistol, such as the caliber .45 Colt automatic, why don't we make a rifle on a similar design? I submit that, among other reasons, the pistol ammunition is much more adaptable for use in an automatic than the conventional .30 Mark I cartridge. The reader will recall our discussion of wall friction, ruptured cases, etc. Moreover, the locking system used in the Colt pistol is not adequate to withstand pressure developed in rifle ammunition. There the lugs on the top of the barrel are caused to drop down from engagement with their recesses in the slide. Incidentally, for the purposes of this discussion, the "slide" on the Colt pistol is, in effect, a breechblock. As such it is locked to the slidably mounted barrel, with which it recoils about one-eighth of an inch. This raises another major point—breech-locking systems.

PRACTICAL METHODS of locking the breech of a high-powered rifle or machine gun, are comparatively limited. The writer has little patience with complicated contraptions of any kind, especially on guns. You will recall our discussion of the need for simplicity above. The interrupted screw is in common use on cannon, but that system on the Ross rifle, for example, was not very satisfactory. One fact remains inescapable. The Mauser-type bolt system has been used throughout the world for the past forty-odd years. Those nations which do not actually use the Mauser bolt, have copied it. Can you name any nations in the world that do not use a rotating bolt with locking lugs in their standard service rifles? In the rifles of a few, the lugs engage abutments located abaft the magazine. In those of a majority, the lugs are situated at the head of the bolt. Bolt-action rifles alone can handle the highest pressures. The locking system used in the model 1895 Winchester proved inadequate for the .30-06. The Mauser bolt system is simple, rugged, and relatively reliable. Many inventors are inclined to ignore the locking system.

Since the war, sporting-arms makers have adopted the rotating bolt in order to provide for the .30-06 and other high-powered loads. I submit that the ideal automatic should use a simplified bolt of the Mauser type. If an inventor can produce a stronger bolt of a similar type, so much the better, provided always that it is practical. In many cases the designer must make concessions in his locking system so that his automatic parts can function as such. I submit that inventors should place primary emphasis on the locking system, and that concessions in design should be made in the actuating parts, not the breechblock.

If, in some simplified manner, a rotating bolt could be designed to operate itself automatically without any extraneous automatic parts, the above difficuty would not arise.

Next we shall discuss modifications of the short-recoil system. (*To be concluded in the November-December issue.*)

2. See illustration (Fig. 1) of the "Remington" autoloading rifle, patented by J. M. Browning June 3, 1902, U. S. Patent No. 701,288. Note the two mainsprings and the enclosure of the barrel.

3. See illustrations taken from a patent by Paul Mauser in 1905. These four drawings of his invention show the various positions of the breechblock and barrel. The first or closed position is shown as Fig. 2. Fig. 3 shows the position at the end of recoil. In Fig. 4 the barrel has moved forward, and in Fig. 5 the gun has been reloaded. This Mauser automatic, primarily is of historical interest, yet it serves to indicate quite graphically the long-recoil system, and is included chiefly for that reason.

Force and Policy

The Power of A State Should Be Feared But Never Its Ambition

By J. M. Scammell*

THE State, War and Navy Building in Washington may be taken as a symbol of the subject of this paper. It is an unlovely but still a practical building. It houses, in addition to the department charged with the administration of our foreign relations, the offices of the Secretary of War and his principal advisers. Its doors are flanked by bronze guns, green with the patina of age, the trophies of ancient victories. On more than one is the Latin motto: *Ultima Ratio Regis*. The day of kings—though not of autocrats—is said to have passed, but the guns that gave them power are with us yet: they are still "the last argument of kings."

Civilized society has long been aware of the dreadful peril to its continued existence as such, that may come from wars in a day when any international conflict may develop into a world conflagration, perhaps more terrible than the last. Gradually the thought is gaining ground that what is needed to combat this danger is a less emotional and a more scientific approach to the problem of the rôle of force in society.[1] This question requires to be examined afresh with all the objectivity of which scholarship is capable. Extremists propagandize their opinions. Some condemn utterly all uses of force by the State. Others exalt it to a level almost unheard of in modern times. Still others would remove force from the sphere of international affairs only to translate it into domestic violence. All these are doctrinaires. Those who serve the social sciences may with profit restudy, in a scientific spirit, the problem of the proper rôle of force in society. For force is like fire: controlled it can be made a useful servant, but when it breaks its bonds it becomes a terrible master.

HISTORIANS may play their part, examining the experience of the race to study the uses of force within the State: they may analyze wars to determine their nature and their causes, the best means for preventing them, or of limiting their ravages.[2]

Of late it has been a fashion amongst historians to condemn the emphasis formerly placed upon the political and military aspects of history and to stress at their expense the social and economic aspects. But, in the past, the difficulty has been less with the relative amount of space devoted to politics and their warlike *sequellae* than with the methods used and with the quality of the treatment. The dramatic content of wars has been exploited, usually with more imagination than real understanding. General historians have shown a need to consult more freely with experts in special fields, and especially with those who have made military history their principal study. This is an intricate and a highly technical subject, for the mastery of which the whole span of life is none too long.[3]

There have also been implications—perhaps unconscious—that there is a distinction between economic, social, political, and military aspects of history, of such a nature that one can be treated adequately only at the expense of others. But even the sharp distinction commonly assumed to exist between the peaceful and the warlike activities of mankind is an artificial and an arbitrary distinction. In every sphere of life competition exists, whether as a struggle for survival, for superiority, for material advantages, or for the dominance of a particular conception of right, and it is only when such competitions become intensified into an extreme form that they are called by the name of war. Moreover, of the 3357 years which elapsed between 1498 B.C. and 1860 A.D., only 227 were years of peace.[4] Conflicts, whether viewed in their peaceful or their warlike aspects, have their economic, their social, their political, and their psychological, as well as their military aspects. Man's nature is intricate in the extreme: the ramifications of his affairs are complex, and the interrelations as the sands of the sea. Wherefore, as Hobbes [5] put it: "In a good history the *judgment* must be eminent, because the goodness consisteth in the *method*, in the *truth*, and in the *choice* of actions that are most profitable to be known."

Now, if today we are to make "choice of actions that are most profitable to be known," we must give systematic attention to the problem of the relations between force and policy. Wars are becoming more frequent, more intense, and more general in their scope.[6] The recent tendency has been for international conflicts to *involve* a greater number of nations and to *affect* them all. Moreover, among the combatant nations, an increasingly large part of the population is drawn, directly or indirectly, into the whirlpool. These conditions allow struggles of an intensity which was rare in the relatively genteel wars of kings. Largely for these reasons, society today trembles for its continued existence in the form of civilized states. In order to survive, it has need of a body of organized knowledge relating to the nature and the causes of wars. Historians can help to build this body of knowledge by holding up a mirror to human life itself, apart from the artificial distinctions between the various ways in which it manifests itself.

The Muse of History can lead us into green pastures. The story of man's age-old yearning for a warless world is itself almost an ungrazed meadow. The field of the rôle of force within the State has long lain fallow. The subject of the control of force in the relations between independent states offers limitless and unfenced ranges. There are fresh prairies as yet unbroken to the plow of scholarship.[7] "The harvest truly is plenteous, but the laborers are few."

Man in the past has rebelled at the din of arms as he has at the fear of illness, poverty, and death. Against such ills in times gone by he has sought sovereign remedies, as in alchemy, in witchcraft, or in a fountain of youth. And it appears that in proportion as he has set his face against simplist solutions, he has made progress. In his fight against "all the ills that flesh is heir to" he has come to rely less on incantations. Instead he has laid bare such preventive measures as are grouped under the titles of hygiene and sanitation. He has unearthed and practiced a wide variety of corrective

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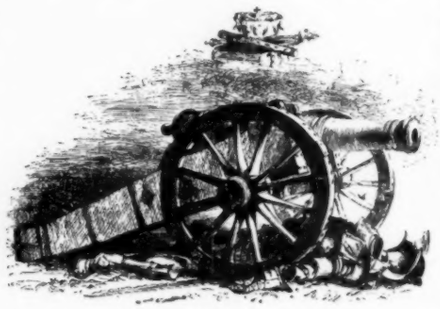
*Former Secretary, American Military History Foundation. Lieutenant Colonel, California National Guard.

1. The reference notes are published in full at the end of the article.

devices known as the science of medicine. His last resort has been the scalpel. Yet even today there are those who reject this knowledge, either wholly or in part. And so it has been with the purge that is the jail and the knife that is the sword. There have been those whose sensitive natures have been revolted by the clumsy devices of the gallows, the iron bars, the baton, the bullet, and the bayonet. But there have been more to protest against the bullet and the bayonet than against the baton, perhaps because the uses of the latter are more easy to demonstrate, or because cold steel is more dramatic and final in its grim and gleaming action.



THE use of force by society to uphold the rules of the commonwealth is the very cornerstone of all civilized human life; so that Hobbes declared, "The Kingdom of God is gotten by violence." [8] And whenever the empire of force has been overthrown, practical statesmen have been led to restore it to its sway. So that if, indeed, "Time is the father of all truth," and if, as Edmund Burke declared, "The species is wise; when *time* is given to it, as a species it is almost always right," we are bound to accept the conclusion of Pascal: "Justice without *Might* is *impotent*. Might without *Justice* is *tyranny*. . . . We must therefore mate Justice with Might, and to that end insure that what is Just is Mighty, and that which is Mighty is Just."

But within the State, peace is assured, not by force alone, but by a mutual though variable relation between it and laws, customs, manners, and morals. Thus Mahan defined the function of force as being "to give moral ideas time to take root." In order that force may remain latent, and that the laws may retain their empire, society has relied upon *custom*, and *education*.[9] But, in the history of the human race, there come times when good customs lose their momentum and corrupt the world. Then, if the vigilance of the State be relaxed, there is substituted for a controlled and regulated compulsion by society, an unrestrained and unregulated use of violence by its members, and we have epidemics of crime, tumults, seditions, and even rebellions against the authority of the State.

Rebellions, according to some, are wholesome; but according to others, not so.[10] Civil wars are commonly more long drawn-out, more widespread in their operations, more bloody, and more cruel than international conflicts.[11] It is an interesting study to contrast the tumults in the Italian city states during the Renaissance, with the wars of the Condottieri during the same period.[12] One reason why civil wars are more to be dreaded than foreign is that they are much more difficult to control: they may result in the dissolution of the commonwealth and in anarchy.

The degree to which the public sword is required to insure domestic tranquillity has been much underrated. Sparta, the classical example of a militaristic state, was militarized less for defense against aggression from without than against perils from within—from a subject population.[13] According to Prescott,[14] the Empire of the Incas of Peru, without powerful neighbors, supported an establishment of some 200,000 soldiers, to maintain internal order. So that it has been said that if a great modern state, such as the British Commonwealth of Nations, were alone on this planet, it could ill afford to reduce its present military establishment.[15] Indeed, our own experience appears to confirm it. When the Constitution of the United States was drawn up, its purposes as expressed in the preamble were: first, to establish justice; secondly, *to insure domestic tranquillity;* and, thirdly, to provide for the common defense. To achieve these ends, a militia was provided *to execute the laws* and *to suppress insurrections*.[16] The latest census of the Republic showed that there are maintained within its confines some 280,000 souls who were classified as "peace officers" of one sort or another. This is a number approximately equal to the combined strength of the standing army together with the militias of all the states. Yet this is not enough: every year many states call forth their National Guards to insure domestic tranquillity. In the fiscal year 1934-1935 more than 35,000 troops were used to supplement the police.[17] So great is the need for the public sword even in a civilized country.

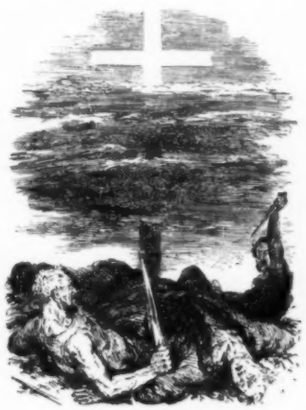
Wherefore "total disarmament" is a means, not to peace, but to universal and perpetual war.[18] We have no choice whether states shall or shall not use the common power within their confines: they must or die. And regardless of whether they should or must, states do make use of armed forces against one another. Things being as they are, our primary concern is that the public sword should be controlled and employed only according to fixed rules. This much lies within our power, for it has proved workable in practice. And this is true whether we consider the use of force by states in their internal or in their external affairs.

In their dealings with one another, states own no common power, and therefore conflicts have always arisen between them. One of the things which history can tell us is how variously philosophers and statesmen have approached the problem of maintaining peace. Over three score of centuries ago Akhenaton, dreaming in Egypt his dream of "the fatherhood of God and the brotherhood of man" revolted against compulsion.[19] In the beginning, a little force might have maintained peace: later great armies marched, and toiled, and fought in vain to restore it. Akhenaton lost an empire, and its downfall preceded a thousand years of anarchy during which a great and promising civilization perished. When thirteen centuries had gone by, there arose in Galilee a Prophet, the Carpenter of Nazareth, known as "The Prince of Peace." [20] His followers have run the entire scale from the extreme of pacifism to warfare in His name.[21] Today the tendency is to forget His use of violence to cleanse the Temple, or His injunction to "render unto Caesar the things that are Caesar's." Remembered is His rebuke to Peter who drew the sword to defend his Master, but forgotten are the Master's words, "If My kingdom were of this world, then would My servants fight."

But, in the course of time a great period of peace came to the Western World, based upon what was in effect a universal dominion. It was known as the *Pax Romana* and it was maintained by the legions of Rome.[22]

The common occurrence of wars during the pilgrimage of mankind through a naughty world offers a variety of

problems to the historian. Among them not the least important is that of surveying all wars with a view to finding out what characteristics they own in common, and thus to define the nature of that abstract thing which we so glibly speak of as "war". This is no novel undertaking. It has been tried before. But the attempts have usually been made by soldiers, and as the unnatural gap between the military and society as a whole has widened, the fruits of their labors have been largely lost. Yet these studies offer a solid basis upon which scholars may build. The heritage of Machiavelli [23] and Bacon,[24] of Lloyd [25] and Guibert,[26] is largely lost. That of Jomini [27] and Clausewitz,[28] of Mahan [29] and Wilkinson,[30] is largely the possession of soldiers.[31] But if it is not a conclusive proof of the value of their works, it is at least a significant fact that they are all in substantial agreement regarding the nature of war. As stated by Mahan, "War is political action. . . . Its purpose is to compass political results, where peaceful methods have failed." Spenser Wilkinson declares that "all wars are acts of force or violence with a political aim," and that war is "the only means whereby a nation can assert against challenge its conception of right."



Another problem is to discover what policies or acts may lead to war and under what conditions. The reverse presents greater difficulties: what policies or acts may keep the peace. A history of the wars that never happened would not be easy to write, but the attempt might be worth while. In our present state of knowledge we might put forth the hypothesis that a state will fight rather than submit to its destruction as such, to overcome obstacles in the way to its becoming that which it believes to be the object of its existence; or a state may feel bound to oppose with violence what another state believes to be to its vital interests.[32] There is a sense in which some wars may be said to be unavoidable—not in retrospect under a lamp in a cloistered study, but in the open air where fogs abound and the strong winds of passion raise great clouds of dust. For the things which make wars appear inevitable at one time may not be understandable at another, ideas changing as they do with the times. Who knows what illumination may spring forth from a systematic analysis of the warlike struggles of the human race?

THE very existence of armaments is often alleged to be an incentive to wage war. Others assert that armaments are in themselves a guarantee of peace. The evidence has never been adequately assessed. Until it is, it might be well to examine the conclusions of those who have given this question their earnest attention. Guibert lived at a time which in many ways resembled our own.[33] He too dreamed of a more perfect state, allied to none, but the friend of all others—though not from mercenary motives. It would be frank and open in its diplomacy. It would be guarded by a national militia composed of citizens devoted to the common welfare. "Make its arms to be feared" cried Guibert, "but never its ambition!" He placed the emphasis where it belongs: on *policy*.

It is this same factor—not the arms themselves, but the character of the people as reflected in their policies—that determines whether the armaments of a state shall preserve it or overthrow it. It depends upon how the government itself, as well as its armed forces, is organized and administered.[34] In a well-regulated state whose citizens are virtuous, instructed, and vigilant, there should be no reason to apprehend that the soldiery should be anything except a deterrent from wars, whether foreign or domestic. So little do we now reflect upon such matters, that of late a revolution has taken place in our military institutions without raising the slightest discussion on the part of political scientists or historians. The militias of the states have been made into a national militia also, susceptible of being mobilized for service anywhere, at a mere order of the President, upon the declaration of a national emergency by Congress.[35]

Now "the command of the militia, without other institution, maketh him that hath it sovereign. And therefore, whosoever is made general of an army, he that hath the sovereign power is always generalissimo." [36] This question of the relations which do or should exist between the head of a state and the armed forces is one which has been much discussed by military men, but less, of late, by our political thinkers and our historians. In our form of government we are confronted by a dilemma: we have a traditional mistrust of professional soldiers; yet the body of citizens from which our principal magistrates are drawn knows little or nothing of military affairs; so that when those who form our policies come into high office they must consult either their own prejudices, or take counsel with men in whom, as a class, they have no confidence. At the very least we should know enough to select our principal military advisers with circumspection, because give them our confidence we must! And yet even this is too little, for experts are not always the most trustworthy advisers. It has been said that "God Almighty never made a nose to suit a nose specialist."

Moreover, war is not primarily a military, but a political act. The line which in theory is supposed to separate policy from strategy is undefined and undefinable, because it is fluid. For this difficulty there is no sovereign remedy except knowledge—to which there is no royal road. With the type of government which we possess, there is no other solution than to assess the facts, and to diffuse the knowledge of them so widely that no man can enter upon a high office without at least an understanding of the essential principles. Meanwhile, "when the blast of war blows in the ears," we have no other recourse than to give great confidence to our soldiers, for "in the kingdom of the blind, the one-eyed man is king."

Today, soldiers generally understand that not only the control of the preparations for war, but its actual conduct, are functions of the civil authorities. As Spenser Wilkinson reminds us: "Only a government can declare war . . . . or conclude a treaty of peace. Only a government can raise and maintain an army and a navy. Only a government can select and appoint commanders of its fleets and armies and give them their instructions."

The commander of an army or of a fleet is—or should be—appointed because he enjoys the complete confidence of his civil commander in chief. He should be maintained in com-

mand as long as he enjoys that confidence; and he should be removed and supplanted as soon as he forfeits it. This is a vital matter. Want of trust at the top is an infection which spreads like gangrene throughout a military organism. It can destroy an army utterly, and almost as swiftly as the wrath of the Lord blasted that of Sennacherib. Now, when soldiers speak of the *complete destruction* of an army, they do not mean physical annihilation. When a man dies, his body, though inanimate, seems much as it was before: but the spark of life is fled. So it is with an army: mutual confidence is its spark of life which unites all its members into one body animated by a single will. When that mutual confidence is gone, an army dies: it is no longer an army capable of performing the things for which an army exists: it is a mass of disorganized units—a helpless mob.

THERE is another aspect of the relation between force and policy that deserves attention. The possibility of war is latent in almost every important decision affecting foreign policy which is made by a state. Policy, therefore, should attempt to foresee the probable consequences of every major decision, and assess them. It should seek to know in advance whether or not a conflict is likely to result. Now if the policy under consideration be thought necessary to the very life of the State or to the future well-being of the nation, mere prudence demands that we look into the probable cost of enforcing it against such opposition as seems likely. The only fit advisers in this matter are the military. They should be *required* to speak; because, as Lord Fisher complained: "When sailors get around the Council Board they are almost invariably mute. The politicians who are 'round that Board are *not* mute; they would never have got there if they *had* been mute. That's why for the life of me I can't understand what on earth made David say in the Psalms, 'A man full of words shall not prosper on the earth.' They are the *very ones* who *do* prosper."

If there is a definite, habitual, and intelligently conceived relationship between those whose business it is to prepare and promulgate policies, and those whose business it is to enforce them, there is little basis for a competition in armaments. A systematic procedure based upon the experience of the past should enable us to forestall such conflicts as may, in their nature, be avoidable, and in any case will do much to insure that an unavoidable war, once begun, may be brought to a swift and successful conclusion.

The "preparedness" so often spoken of by soldiers and other advocates, as a means of preventing or of shortening wars, should be, above all, an *intellectual preparedness* on the part of our statesmen as well as of our soldiers. For statesmen not only determine whether or not we shall go to war, but they also determine largely when and where wars shall be fought, with what forces, and under what conditions. Thus, they are sometimes responsible for their duration, for the ultimate success or failure, beyond the power of the military to remedy.

This responsibility of the civil authorities has become an increasingly great matter. As modern states have grown in complexity, they have tended to make the direction of wars depend more largely upon the nature and degree of the preparations made in time of peace. The consequence is that wars have become progressively shorter. It is plainly no mere coincidence that the "Hundred Years' War" was followed in time by the "Thirty Years' War," and that, in turn, by the "Seven Years' War," and that, finally, by a "Seven Weeks' War." There is evident a definite relationship between the degree of preparation for wars and their duration. From 1850 to 1871 there were great wars in Europe, Asia, and America. In Asia the Taiping Rebellion, fought with improvised armies, lasted thirteen years and cost more lives than all the other wars of the nineteenth century, with the War of 1914-1918 thrown in for good measure. In our War Between the States we had a nucleus of trained soldiers, a mediocre militia, and large numbers of volunteers and conscripts. This war lasted four years and cost 300,000 lives. The wars in Europe were fought almost entirely by trained troops. That in the Crimea lasted a year and a half. The Campaign of 1859 in Italy lasted three months. That of 1866 between Prussia and Austria lasted seven weeks and was decided in one pitched battle. The fighting in the Franco-Prussian War lasted six months. In the War Between the States the loss of life amounted to seventeen per cent of the troops engaged, and in the Austro-Prussian War to five per cent. The Prussian Army in the War of 1870-1871 lost four per cent. The wars waged by untrained men, especially under untrained leaders, are longer, more bloody, and more destructive and cruel. Force is controlled and controllable only in part, and it can not be directed economically in time and space and to a definite, decisive end.[37]

THE State, War and Navy Building is not only a fitting symbol for the subject of this paper, but it symbolizes also, by its location, the common state of mind with regard to it. The building is an anomaly completely surrounded by incongruities. It no longer houses the naval administration. It shelters only a vestigial remain of the War Department. It is flanked on its right by the mansion of the Chief Executive and on its left by a peace society and the offices of the General Staff. It fronts upon a single court of law, one naval and three military societies, and two more peace societies. Its back is turned upon a monument to our dead in battle.

The *physical* juxtaposition of the agencies of policy and of force is no great matter: that which is vital is that the actual relations between them should be close, definite, habitual, and based upon realities. It is the task of those who hold that "truth is the eye of history" to discover these realities, lest in the future we fight needless wars, or allow such as may be necessary to drag on to the exhaustion of the nation. "Histories make men wise" only when they are wisely written. And if those who are to train our future statesmen and future makers of public opinion allow the darkness to prevail over the light in this field, they shall not be held guiltless of their country's blood.

REFERENCES: 1. The theme "study wars" runs through the works of Spenser Wilkinson, and is developed in detail in his lecture "The University and the Study of War": Oxford, Clarendon Press, 1909. See also his "War and Policy": New York, Dodd, Mead, 1900; "Some Neglected

Aspects of War": London, Oxford University Press, 1917; "Government and the War": London, Constable, 1918; "Britain at Bay": London, Constable, 1909; "British Aspects of War and Peace": London, Duckworth, 1920. Woods and Baltzly in the introduction to their work "Is War Diminishing?" (New York, Houghton Mifflin, 1915) insisted upon the need for a scientific approach to the problem of war and peace. In 1923 Mr. J. B. S. Haldane, Mr. Lyman Bryson, and the writer met in Paris and discussed the subject. There followed Mr. Haldane's "Science and Politics" in *The New Republic,* 41 (December 3, 1924), 34-35; Mr. Bryson's "School for Peacemakers" in *The Atlantic Monthly,* 135 (June, 1925), 848-855; and the writer's "Perseus and the Sphynx, or Science and War" in *The U. S. Naval Institute Proceedings,* 53:2 (February, 1927), 179-183. See also O. Glazer, "Science and the War against War" in *The World Tomorrow,* 7 (February, 1924), 46; J. A. Ewing, "Science and Some Social Problems" in *The Hibbert Journal,* 31 (April, 1933), 321-326. Edward Glover in his "War, Sadism and Pacifism" (London, Allen & Unwin, 1933) proposed a "1000-year program" of scientific research into the psychological problems connected with war! Liddell Hart in his latest book "When Britain Goes to War" (London, Faber & Faber, 1935) emphasized the need for a scientific study of wars. "Why not a Science of Peace" was the title of Dr. Robert J. Kerner's Armistice Day address at the University of California, November 11, 1935.

2. This question was discussed during the conference on military history held by the American Historical Association at Harvard University in 1912. Cf. the Annual Report of the American Historical Association for 1912 (Washington, 1914), 159-197. The proceedings were published also in the *Infantry Journal,* January-February 1913.

3. A view emphasized by Spenser Wilkinson. It is regretted that the specific reference cannot be given in this case and in some others, owing to the fact that the writer's library and notes were traveling at the time this paper was written. Within the limits of the time available and the resources of the Library of Congress, references have been checked wherever possible. The following, from the "Memoirs of the Life of Edward Gibbon" (New York, Putnam's Sons, 1900, 138) may be of interest in this connection: "The discipline and evolutions of a modern battalion gave me a clearer notion of the phalanx and the legion; and the captain of the Hampshire grenadiers (the reader may smile) has not been useless to the historian of the Roman Empire." And Gibbon studied the works of Messrs. Folard and Guichard also. *Ibid.,* Note 2.

4. H. Westen. "Armistice Day Total Shows 44 Wars in 17 'peace' Years" in the *Washington Post,* Sunday, November 10, 1935, Sect. III, 5, 12. The data for Mr. Westen's article were furnished by the Library of the Carnegie Foundation for International Peace. The particular figures cited here are from Bloch, I. S., "The Future of War": Boston, Ginn & Co., 1899, lxv.

5. "Leviathan", viii (Routledge Edition, undated, 41).

6. Woods and Baltzly. *Op. cit.* in Note 1. Cf. also Bodart, G., "Losses of Life in Modern Wars": Carnegie Endowment for International Peace, Oxford, Clarendon Press, 1916. From 1588 to 1926 there were some 100 wars or one to about every 40 months. From 1860 to 1914 there were 32 wars, or one to every 20 months. From 1918 to 1935 there were 44 wars, or one on an average of about every 4½ months! This calculation is based upon figures furnished by the Library of the Carnegie Endowment for International Peace.

7. Eleven years after the conference on military history at Harvard referred to in Note 2 above, Professor Charles Haskins in his Presidential Address to the American Historical Association, at New Haven in 1923, said: "Naval history has scored triumphs. Military history is in many respects in its infancy." *American Historical Review,* XXVIII (January, 1923), 215-27.

8. "The employment of force for the maintenance of right is the foundation of all civilized human life. . . . The right or wrong is not in the employment of force but simply in the purpose for which it is used. . . . Violence in resistance to violent wrong is not only right but necessary." Spenser Wilkinson, "Britain at Bay," 22: Professor Wilkinson asserts that the identification of force with right is sovereignty itself, and that the "abolition" of war amounts to the abolition of the State. *Ibid.* 33.

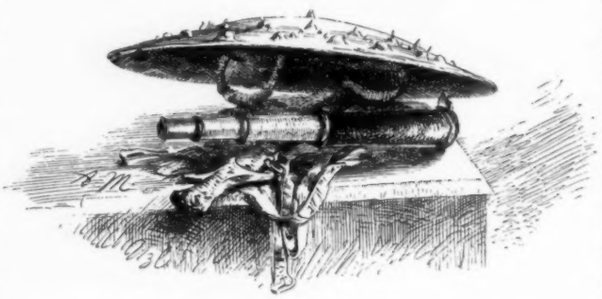
9. "Men's thoughts are much according to their inclination; their discourse and speeches according to their learning and infused opinions; but their deeds are after as they have been accustomed. . . . The predominancy of custom is everywhere evident, insomuch as a man would wonder to hear men profess, protest, engage, give great words, and then do just as they have done before." Bacon's essay on Custom.

10. "God forbid," said Jefferson, "that we should be twenty years without a rebellion." But to Herodotus, faction was as much worse than war as war is than peace. Thucydides' description of *stasis* (iii, x, 70-86, and viii, xxv, 66) bears out Herodotus. Livy stated that civil commotions have been and will be more ruinous to the majority of states than foreign wars. Bacon compared internal strife to the heat of a fever, and foreign war to the heat of exercise. Cf. Westermann's dispatch to the Committee of Public Safety during the revolt in La Vendee in 1793: "I have crushed the children under the hoofs of the horses, massacred the women who . . . . will breed no more brigands. I have not a single prisoner with which to reproach myself. I have wiped out all. . . . The roads are strewn with corpses. . . . We take no prisoners: it would be necessary to feed them with the bread of Liberty." Cited from Quarré de Verneuil's "La France Militaire pendant la Révolution": Paris, Dumaine, 1878, 29. The Union Catalogue in the Library of Congress does not list this work.

11. The Taiping Rebellion is said to have cost 20,000,000 lives. Hail, W. J., "Tseng Kuo-fan and the Taiping Rebellion": New Haven, Yale University Press, 1927, xiii, citing S. W. Williams' "Middle Kingdom."

12. "Combatants then engaged with little danger, being nearly all mounted, covered with armor, and preserved from

death whenever they chose to surrender. . . . In a battle which continued four hours, only one man died, and he neither from wound nor gallant blow, but having fallen from his horse he was trampled to death." Machiavelli's "History of Florence": London, Bohn, 1854, vii, 251.



13. Thucydides, an Athenian, described the Spartans as being "of old slow to go to war except under the pressure of necessity." He has the Corinthians contrast the Athenians with the Spartans in these words: "They (the Athenians) are never at home, you (the Spartans) are never from it: for they hope by their absence to extend their gains, *you fear by your going forth to endanger what you have left behind*" (I, iii).

14. "History of the Conquest of Peru": 2 vols., Philadelphia, Lippincott, 1868, Bk. I, Chap. ii (Vol. I, 72).

15. Vestal, S. C., "The Maintenance of Peace, or the Foundations of Domestic and International Peace, as Deduced from a Study of the History of Nations": New York, Putnam's Sons, 1920.

16. The following extract from a letter of W. T. Sherman to General Meigs (February 5, 1890) is quoted from A. T. Mahan's "Some Neglected Aspects of War" (Boston, Little, Brown, 1907, 52-53): "From 1861 to 1865 the Supreme Court was absolutely paralyzed: their decrees and writs were treated with contempt south of the Potomac and Ohio; they could not summon a witness or send a deputy marshal. War and the armed power of the Nation alone . . . . restored to the U. S. courts their lawful jurisdiction."

17. Annual Report of the Chief of the National Guard Bureau, 1934-1935.

18. War as defined by Hobbes in his "Leviathan" (xiii): "During the time men live without a common power to keep them in awe, they are in that condition called 'war'. . . . The nature of 'war' consisteth not in actual fighting, but in the known disposition thereto during all time there is no assurance to the contrary. All other time is peace."

Spenser Wilkinson ("Britain at Bay", 29-33) states that in the society of nations there are no parallels to civil and criminal courts within the states, because these courts derive their authority from the sovereignty of the State, and the society of nations owns no sovereignty. Therefore any objection to the use of force between states involves a proposal to set up a world state. Compare Hindmarsh, A. E., "Force in Peace": Cambridge, Harvard University Press, 1933. "Abolition" is a word too loosely used. Piracy, the slave trade, the duel, cannibalism, and other practices said to have been abolished, are not dead but only sleeping.

19. Breasted, "Ancient Records of Egypt": 5 vols., University of Chicago Press, 1906, II, sections 932-1018; Weigall, A., "The Life and Times of Akhenaton": London, Blackwood, 1911. Weigall assesses the responsibility of Akhenaton for the political consequences of his idealism, but declines to express any final conclusion. Compare the Emperor Wen of China who rebuked Wu-tsu for presenting him with a work on war: "Why do you give me this? I do not like war or anything connected with it." But Wu convinced his Emperor of the need to study war. Note also the plaint of Se-ma, another early Chinese writer on war: "One can still make war, give battle, invade cities, provinces and kingdoms: considering the actual state of culture one cannot possibly doubt this. But before one comes to such an extremity, one should make sure that one has humanity for his object, justice for his sole aim, and right as his only guide. One should never make a decision which will result in the death of fellow men except to preserve the lives of a greater number." Amiot, J. M., "Art militaire des Chinois": Paris, Didot l'ainé, 1772. Père Amiot was a Jesuit missionary who translated the works of Sun-tsu, Wu-tsu, and Se-ma, Chinese writers on war. Sun-tsu lived *circ.* 425 B. C.

20. Apart from any question of the value of the Gospels as historical documents, the teachings contained therein have had a profound historical influence.

21. With the adoption of Christianity as a state religion, it was "In hoc signo vinces!" During the Middle Ages bishops were sometimes away fighting the Norman invaders, so that the business of the Church suffered! Not only bishops, but archbishops, cardinals, popes, and saints bore arms. A pope led a storming party into the breach of a besieged city. A cardinal commanded at the siege of La Rochelle with an archbishop as his admiral. Saint Louis and Saint Joan led armies. The Church gave its blessing to the institution of chivalry. In our own country the Bishop of Louisiana, Leonidas Polk, was a doughty warrior in the War Between the States. The writer has collected some curious data on this subject which he hopes to publish under the title "Clergymen-at-arms".

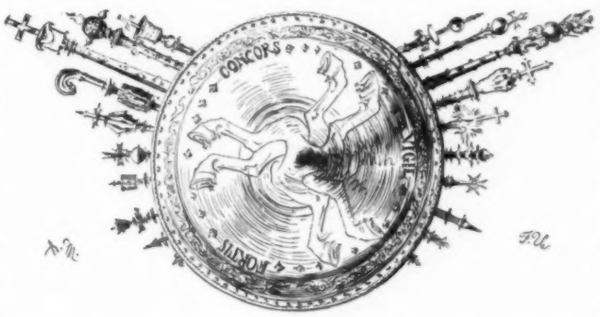
22. "If a man were called to fix the period in history during which the condition of the human race was most happy and prosperous, he would without hesitation name that which elapsed from the death of Domitian to the accession of Commodus." Among the rulers of this time was Marcus Aurelius Antoninus: "War he detested as the disgrace and calamity of human nature; but when the necessity of a just defense called upon him to take up arms, he readily exposed his person to eight winter campaigns on the frozen banks of the Danube, the severity of which was at last fatal to the weakness of his constitution. His memory was revered by a grateful posterity, and above a century after his death, many persons preserved the image of Marcus Antoninus among those of their household gods." Gibbon, "The Decline and Fall of the Roman Empire": 2 vols., New York, The Modern Library, I, 69, 70.

23. "The Prince," xii, xiii, xiv; his work on warfare, and passages in his other works.

24. Bacon appears to have drawn freely on Machiavelli without sharing in the largely unwarranted opprobrium that attaches to the name of Machiavelli.

25. Lloyd, Henry, "Mémoires Militaires et Politiques": Paris, Magimel, An IX (1801). In addition to that owned by the writer, copies of this interesting work are to be found in the New York Public Library, in that of the U. S. Military Academy, and that of Harvard College. Lloyd was a studious

Welshman who took service abroad. His writings were highly prized during the latter part of the eighteenth and early part of the nineteenth centuries, and ran through a considerable number of editions.



26. Guibert, Jacques Antoine Hippolyte comte de, "Oeuvres militaires": 5 vols., Paris, Magimel, An XII (1803). The only copy of Guibert's complete works listed in the Union Catalogue is in the U. S. Engineer School Library. The writer has a set. Guibert's "De la force publique" (Paris, Didot l'ainé, 1790) is in the Harvard College Library. The Library of Congress has Guibert's "Essai général de tactique; précédé d'un discours sur l'état actuel de la politique et de la science militaire en Europe": 2 vols., Liège, Plomteux, 1775. Guibert's works were highly prized by Frederick the Great and Napoleon. The editor of the 1803 edition claims that "Washington (*sic!*) made it the companion of his glory"; but if so, it must have been in translation as Washington did not read French. As no copy was found in Washington's library, it may be surmised that he knew the works through others. There are clear evidences of Guibert's influence in Washington's Farewell Address.

27. "Histoire critique et militaire des guerres de la révolution:" Paris, Anselin & Pochard, 1820; "Précis de l'art de la guerre, ou nouveau tableau analytique des principales combinaisons de la stratégie, de la grande tactique et de la politique militaire:" Paris, Anselin, 1857. On the basis of Professor Merriam's criterion of "predictability value", the historical studies of Jomini must be given a high rating, for he was able to forecast events with a remarkable accuracy.

28. Clausewitz, Carl von, "Hinterlassene werke des generals Carl von Clausewitz über Krieg und kriegsführung": 10 vols., Berlin, Dümmeler, 1832-1837. Volumes 1-3 contain his "Vom Kriege". Clausewitz, the bible of the soldiers of the nineteenth century, has suffered in reputation, because his works, being exceedingly difficult to read and more difficult to understand, became the property of soldiers largely through commentaries and interpretations, or rather misinterpretations. See the criticism in Chapter 5 of Liddell Hart's "When Britain Goes to War", with which the writer is in substantial agreement.

29. Apart from his indispensable work "The Influence of Sea Power on History" (Boston, Little, Brown, 1890), Mahan deals with the general subject of this paper in other works: "Armaments and Arbitration, or the Place of Force in the International Relations of States:" New York, Harper & Bros., 1912; "Lessons from the War with Spain:" Boston, Little, Brown, 1899; and "Some Neglected Aspects of War:" Boston, Little, Brown, 1907.

30. See Note 1 above.

31. Colonel Réné Tournès of the Historical Section, French General Staff, makes the point ("L'Histoire militaire": Paris, Lavauzelle, 1922, pp. v-xiii) that the disasters which befell the French Army during the World War were due largely to the inability of the military to discriminate between sound and unsound histories; so that the French General Staff based its doctrine of war upon a documentation of a disconcertingly fantastic character. Soldiers have need of the counsel of historians no less than historians have need of the advice of soldiers—and ask it less readily. The Union Catalogue lists Colonel Tournès' work in a Spanish translation ("La historia militar:" Buenos Aires, L. Bernard, 1925) as being in the New York Public Library.

32. Following the works of Spenser Wilkinson, cited in Note 1, Charles A. Beard in his recent work "The Idea of National Interest, an Analytical Study in American Foreign Policy" (New York, Macmillan, 1924), has attempted to clarify this vague expression "national interest". Mahan ("Some Neglected Aspects of Wars," xvii) defines "vital" interests as "those of a community and of posterity." They are, he says, "interests 'in trust'." John Bakeless has a chapter ("Origin of the Next War:" 1926, ix) on "Wars that Missed Fire."

33. "Oeuvres militaires," I, 15-16, 19: "The mass of national debts increases. Credit suffers. . . . Each state is seated amidst its own debris . . . . sharpening its sword. . . . Amongst the treaties designed to pacify them there remain always the germs of future controversies which, after a brief truce, cause them to arm afresh against one another."

34. The history of the Roman Empire in the East, especially as compared with the Roman Empire in the West, is an almost unworked mine of information on this question. Lloyd (*Op. cit.*, 241-43) has some interesting observations: the monarchical form of government leads to slow, indecisive wars unless the monarch himself is a warrior. A professional army tends to gain undue influence over a government in proportion as it is removed from the common life of the nation and in proportion as the people themselves have already lost their liberties, when social inequalities provide soldiers whose only prospects lie in military service, and when their officers form a caste apart. From such dangers our own military establishment is largely secured, by the institutions of the National Guard, the Organized Reserves, the R.O.T.C., and other agencies which tend to bring the professional soldiers into closer contact with society as a whole.

35. Act of June 15, 1933 (National Guard Status Bill), amending the National Defense Act.

36. "Leviathan," xviii ("Ninthly").

37. "As the English were novices and had never been in any war before, they were quite regardless, and killed the prisoners whom the Spaniards could not protect." The Spaniards mutinied: " 'How now! Do you think that we are in the King's service for the four ducats a month we earn? Not so, my lord. . . . We serve with the hope of taking prisoners and getting their ransom.' And Salablanca said, 'My lord, they have killed a gentleman of mine for whom I should have had at least five or six thousand crowns' ransom.' "—*Chronicle of King Henry VIII,* lvi, 119.

EDITOR'S NOTE—The illustrations in this article are reproduced from Adolph Menzel's "Illustrationen zu den Werken Friedrichs des Grossen," Berlin: R. Wagner, Kunst- und Verlagshandlung, 1886. Menzel (1815-1905), the noted German engraver, revived the art of engraving on wood.

The "Pepper-Box" Pistol

That Strange Weapon With Revolving Barrels

By S. Basil Haw*

A GREAT deal of obscurity exists regarding the early history of the revolver, but one is possibly safe in assuming that the designs of the two main systems—revolving chambers and revolving barrels—occurred to experimental gunsmiths of the period about the same time. Of the two, the revolving-chamber system has the longer history and there are in existence, scattered throughout the world in private and in public collections, a large number of early models of varying design and origin equipped with every type of ignition from the matchlock onwards.

On the other hand, the revolving-barrels system has rather a short history, and it is not far from the truth to say that it covers little more than a century in its more developed form. The simplicity of its design and the fact that its construction entailed no great precision of workmanship must have attracted the attention of many of the early gunsmiths, but there is little doubt that they soon realized its particular disadvantages—those of bulk and weight. The system of rifling was in its infancy in those days and was by no means widely known or adopted. The only way to obtain any sort of accuracy in a smooth-bore arm and, at the same time, to insure the full force of the rather slow-burning powder of the period, was by fitting a fairly long barrel. But every additional inch in length would add very considerably to the weight in the case of a multibarreled arm, and before the point of comparative accuracy was attained, it would certainly become absurdly cumbersome. It was for this reason that shoulder arms were very rarely constructed on the system and that it was applied almost entirely to pistols.

FOUR-BARRELED pistols of the revolving type were made as early as the middle of the seventeenth century. The barrels of these were invariably turned by hand and were held in the firing position by a simple spring catch. Each was equipped with a separate frizzen and pan unit which came in turn under the single side hammer at the breech.

Pistols of this description were produced intermittently throughout the flintlock era in the various gun-manufacturing countries though they do not appear to have enjoyed any great popularity. A variation which seems to have found more favor in the public eye and which was manufactured in greater quantities was the four-shot "turn-over" (strictly speaking "double double-barreled") pistol which had its barrels set in square formation, with two central hammers and two triggers.

Throughout this period, multishot pistols—apart from very occasional specimens of the true revolver or of the roller-breech magazine pattern—rarely exceeded a capacity of four loads. The change came somewhere between 1780 and 1800 when the first true "pepper-box" pistol was put on the market in England. Despite the fact that these arms are classified as rare, they are to be found in a number of private and public collections and it is obvious that they were manufactured in fairly large quantities. Usually marked with the names of various London or provincial gunsmiths, they are so similar in design that it seems almost certain that they originated from one manufacturer and were distributed by him to members of the retail trade. His identity has never definitely been established. The general opinion seems to be that he was Nock, the famous London gunmaker.

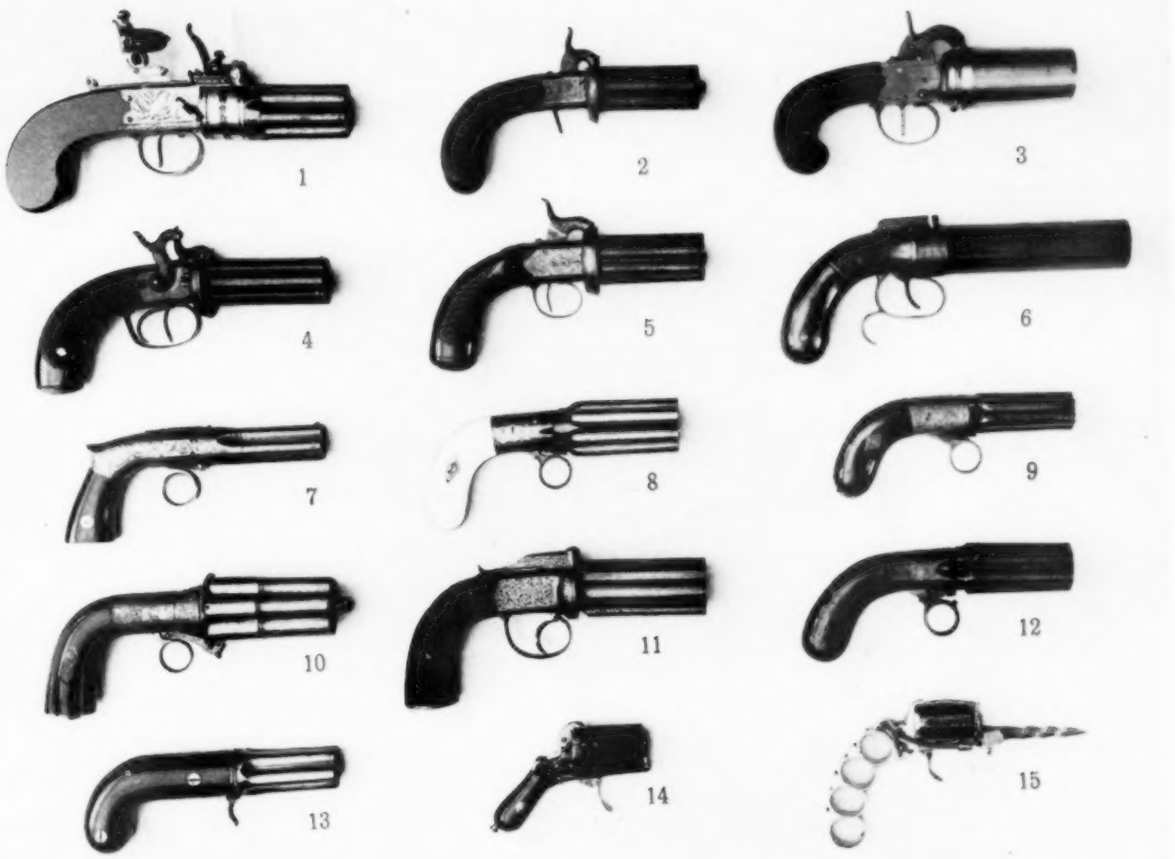
In most cases these pistols were fitted with six short barrels screwed in cylindrical formation on a revolving breechblock. These pivoted around a seventh barrel, the vent of which was so connected that it was discharged simultaneously with the first of the outer ring. Round the side of the revolving breechblock were a series of cavities of sufficient size to accommodate a charge of priming powder, each communicating by means of a vent with one of the barrels. The priming was held in place by a broad metal band which fitted closely round the block and on top of which was fitted the pan and the frizzen. The pan itself was shallow and open at the bottom, so that the powder in each of the priming cavities in turn was exposed to the sparks from the lock. The cluster of barrels was revolved by hand, each being held in position for discharge by means of a sprung ratchet catch inside the breech of the pistol. Fig. 1 shows a typical seven-shot specimen.[1]

The invention of the fulminate system of ignition in 1807 and the subsequent development of the percussion cap caused a certain revival of interest in the revolving system generally in the first two decades of the nineteenth century. The famous "Collier" revolver was, it is true, a flintlock arm, but this system of ignition was beginning to become obsolete, and it is interesting to note that the contemporary experimental revolvers of Lenormand and one or two other Continental makers were fitted with fulminate locks. At the same time there was evidence of a renewed interest in the multibarreled revolving pistol, and a number of hand-rotated percussion-lock arms of this type began to appear on the market in England and probably in other gun-manufacturing countries as well. Though many were obviously of new construction throughout, it is interesting to note that a large number were made of old single-shot pocket pistols. Fig. 2 is a typical example of the former class, while Fig. 3 (which was no doubt the work of some ingenious country gunsmith) appears to have been made out of an old flint-lock pistol. Both specimens are, incidentally, of British origin.

Details of design varied considerably, but in most cases the barrels were drilled out of a cylinder of brass or steel and the separately screwed barrel system of the "Nock" flintlock pistol appears to have been abandoned. The number varied from four to six, with calibers rarely greater than between .32 to .36. Either central or side hammers were fitted, together with plain or folding triggers. Fig. 4 shows an unusual six-shot specimen, having double hammers and the nipples set at a slight tangent. It is fitted with a foresight on each barrel—an item rarely found on such arms.

*Private collector and student of antique arms, Green Heys, Sidcup, Kent, England.

1. Nock also manufactured a few hand-rotated multibarreled carbines of similar design, but equipped with a priming magazine on the frizzen.



From the J. N. George Collection, Chislehurst, England.

"PEPPER-BOX" PISTOLS

1. "Nock" (English); flint-lock; hand-rotated; cal. .36; 2⅜-inch barrels; 7-shot. 2. Hand-rotated (English); folding trigger; cal. .36; 3⅛-inch cylinder; 5-shot. 3. Hand-rotated (English); cal. .50; 3⅜-inch cylinder; 4-shot. 4. Hand-rotated (English); two hammers; cal. .36; 3½-inch cylinder; 6-shot. 5. "Lang" (English); single-action; cal. .38; 3¼-inch cylinder; 6-shot. 6. "Allen & Thurber" (American); cal. .36; 5¼-inch cylinder; 6-shot. 7. "Leonard" (American); cal. .31; 3½-inch cylinder; 6-shot. 8. "Mariette" (French); cal. .36; 2¾-inch barrels; 6-shot. 9. "Mariette" (French); cal. .31; 3-inch cylinder; 6-shot. 10. "Lefaucheux" (French); cal. 15-mm.; 3½-inch cylinder; 6-shot; 11. Standard English pattern; cal. .45; 3½-inch cylinder; 6-shot. 12. "Cooper" (English); cal. .38; 3-inch cylinder; 6-shot. 13. "Budding" (English); hand-rotated; cal. .31; 2¾-inch cylinder; 5-shot. 14. "Fist" revolver (French); cal. 7-mm.; 1¾-inch cylinder; 6-shot. 15. "Apache" pistol (French); cal. 5-mm.; 1½-inch cylinder; 6-shot.

THE next and most important stage in the development of the "pepper-box" pistol was the introduction of a lock which rotated the group of barrels automatically. The mechanism of these new arms falls into two classes—single-action and self-cocking—and it is difficult to decide which of the two was first employed. Nor can one assign the credit of producing the first model to any particular inventor with any degree of certainty.

The single-action mechanism, applied to revolving-chambered arms, can actually be dated back to the seventeenth century,[2] but it does not appear to have been applied to any flintlock pistols of the revolving-barreled type. In 1836, however, the U. S. Patent Office granted to Barton and Benjamin Darling a patent for a percussion-lock "pepper-box" pistol of this pattern. The single-action English model (by Lang, of London) illustrated here (Fig. 5) was made about the same time, judging by the style of finish, and during the next twenty years or so a fairly large variety of similar arms was produced.

They were, however, greatly outnumbered by those fitted with the self-cocking mechanism. The reason for this lay in the fact that the "pepper-box" pistol was essentially designed for a rapid succession of shots at short range and in this respect the latter type of lock undoubtedly held the advantage. The inherent peculiarities of the multibarreled arm's design rendered accurate-aimed fire almost impossible and the chief merit of the single-action mechanism—minimum disturbance of aim—was therefore rather wasted on it.

The early history of the self-cocking mechanism, in which the action of drawing back the trigger raises and releases the hammer and simultaneously rotates the chambers or group of barrels (whichever may be the case) is obscure. Lenormand, a gunsmith of Paris, is said to have employed it in a five-chambered fulminate-lock revolver which he constructed as early as 1820. In the absence of evidence to the contrary, it is possibly correct to credit him with the honor of being the originator of the lock, with the reservation that it may have occurred to an even earlier but unknown experimenter. There

2. The United Services Museum, London, contains an interesting six-chambered snaphaunce petronel of this period whose cylinder is rotated automatically. From a sketch of the mechanism which is included in "Our Engines of War" by Capt. J. W. Jervis (1859) it would appear that the cylinder moves with the fall of the hammer.

have been, no doubt, many obscure gunsmiths and amateur designers who have hit on revolutionary ideas, but failed to carry them beyond the experimental stage through lack of funds or through insufficient faith in their inventions. A case in point is that of Henry Humberger, of Somerset, Ohio, who, according to a recently published work of reference,[3] is said to have designed and constructed a self-cocking "pepper-box" pistol as early as 1832.

Samuel Colt, in the course of a lecture which he delivered in London in the fall of 1851,[4] stated that he had employed the self-cocking system in some of his early experimental revolvers and had finally abandoned it owing to its tendency to disturb a steady aim. This was during the period between 1831 and 1835. A curious combination bowie-knife-revolver weapon with that type of lock [5] was made at his first factory at Paterson, N. J., in 1836, but did not form part of the firm's regular output. Probably only half a dozen or so were actually produced.

In 1834 Ethan Allen, of Grafton, Mass., invented a very simple and ingenious self-cocking lock, which he first applied to single-shot screw-barrel pistols. Three years later he took his two brothers-in-law (Chas. T. Thurber and Thos. P. Wheelock) into partnership and the new firm (Allen, Thurber & Co.) started to manufacture the first of the "Allen" six-shot "pepper-box" pistols. In the same year Mariette, a French gunsmith, produced a similar arm, which differed in several constructional details from the American model. The first patent issued by the British Patent Office in respect of a self-cocking "pepper-box" pistol was granted to Geo. Stocker and Jos. Bentley in 1839. It concerned details of a special nipple-shield and it is significant that the patentees disclaimed any right to the general construction of the pistol itself since it was, as they remarked, "in common use".

It seems almost certain, therefore, that by the close of the 1830's this new rapid-fire pistol had become part of the average gunsmith's stock-in-trade in the main manufacturing countries. The nickname "pepper-box"—due to the similarity between the business end of that homely utensil and the clustered muzzles of the new pistol's barrels—was probably coined about the same period.

THE American market was undoubtedly dominated by the famous "Allen & Thurber" pistol (Fig. 6) which was first produced in 1837. It was manufactured in very large quantities, with barrels ranging in length from 2½ to 5¼ inches and in caliber from .31 to .36. A few single-action specimens were made, but the greater part of the output was fitted with an adoption of Allen's self-cocking lock of 1834. The main feature of the latter was the ingenious economy of its design (the mainspring served also as a trigger and sear spring), but in attaining simplicity Allen had sacrificed a certain amount of ease of operation, for the trigger action was unpleasantly heavy. The pistol itself was constructed on simple lines which bore a considerable resemblance to those of contemporary British design. The only point of interest, apart from the details of the lock, lay in the construction of the nipples. These were mounted vertically round the side of the rear end of the cylinder, partially sunk in to avoid lateral flash, and were not detachable, being cut out of the solid metal—a decidedly unusual feature. They were encircled by a wide metal band which served the double purpose of shielding the caps from being struck accidentally and of preventing them from being shaken off by the jar of the explosion.

Those who have read Mark Twain's "Roughing It" will recall his amusing, if libelous, account of the "Allen's" performance. In describing the arms carried by the passengers of the Overland Stage coach he wrote: "Mr. George Bemis was dismally formidable. George Bemis was our fellow traveler. We had never seen him before. He wore in his belt an old original revolver, such as irreverent people called a "pepper-box". Simply drawing the trigger back cocked and fired the pistol. As the trigger came back, the hammer would begin to rise and the barrel to turn over, and presently down would drop the hammer and away would speed the ball. To aim along the turning barrel and hit the thing aimed at was a feat which was probably never done with an "Allen" in the world. But George's was a reliable weapon nevertheless, because, as one of the stage drivers afterwards said, 'If she didn't get what she went after, she would fetch something else'. And so she did. She went after a deuce of spades, nailed against a tree once, and fetched a mule standing about thirty yards to the left of it. Bemis did not want the mule, but the owner came out with a double-barreled shotgun and persuaded him to buy it, anyhow. It was a cheerful weapon, the "Allen". Sometimes all its six barrels would go off at once and then there was no safe place in all the region round about, but behind it."

MOST other American makes show very distinctly the influence of the "Allen" in the details of their construction and even in cases (such as the "Stocking" pistol) where the lock mechanism differed entirely, the butt and general breech design are more or less the same. The only two which show any distinct difference from the general standard are the "Pecare & Smith" and the "Leonard".

The former is rather a rare arm and does not appear to have been manufactured in any great quantity. It had a folding trigger and a horizontally operating internal striker. The nipples were set in line with the barrels which were drilled out of a solid cylinder, covered with a detachable iron sheath. The "Leonard" pistol (Fig. 7) though of rather unusual construction, undoubtedly enjoyed a certain popularity and is more often encountered nowadays.

Patented in 1849 and manufactured by the firm of Robbins & Lawrence, of Windsor, Vt., it was a radical departure from standard "pepper-box" design. The cylinder, drilled with from four to seven barrels was fixed. The discharge of each barrel in turn was effected by means of an "eccentric" head fitted to the end of an enclosed horizontal spindle. The loading procedure was rather curious. The cylinder was made in two portions, the rear one being just large enough to contain the charges. The forward—and larger—portion could be unscrewed and moved forward on the supporting spindle sufficiently to enable the powder and the balls to be loaded into the rear one. The process of loading being finished, a spring catch on top of the breech was pressed down. This released the cylinder block which was hinged to the breech just in front of the trigger and enabled it to swing downwards, exposing the nipples (grouped in circular formation) which were sunk into its solid end. When the caps were placed on

3. "Arms Fabricators Ancient and Modern" by R. E. Gardner.

4. Minutes of Proceedings of the Institution of Civil Engineers. Vol. 11. "On the application of Machinery to the manufacture of Rotating Chambered-Breech Firearms, and the peculiarities of those Arms". By Colonel Samuel Colt.

5. Included in a folding plate of illustrations which accompanies the above.

these, the cylinder was returned to position again. The pistol was then ready for discharge.

Pressure on the ring trigger drew back the firing spindle and rotated it slightly, bringing the head into line with one of the caps. Only a slight pressure on the curiously shaped forward trigger which lay directly in front of the other, was required to fire the pistol. A repetition of these actions would fire the next barrel, the striker head having moved round just sufficiently to bring itself into line. The ring trigger could be unlocked from the full-cock position and the striker set at ease by pressing a small stud on the rear strap of the butt. There were two other rather unusual features—the barrels were rifled and sights were fitted.[6]

THE principal French make was the "Mariette" (Fig. 8) to which reference has already been made. It was first produced in 1837 and seems to have enjoyed a virtual monopoly both in France and in Belgium. It differed from contemporary American and British arms in several respects, the most noticeable of these being the design of the barrels which were made separately and were screwed on a revolving breech-block. The striker was pivoted under the breech just in front of the ring trigger and struck forward against the horizontally set nipples, the mechanism being of the self-cocking type.

It was a well-made and smoothly working arm. The system of separate barrels considerably reduced the weight and thus permitted the fitting of a wide variation of barrel lengths. These ranged from three to six inches in length; in caliber from .30- to .50-inch; in number from four to as many as eighteen, those in the latter case being set in two concentric rings. One contemporary writer asserts that as many as twenty-four were fitted to some models; an early example of the rather exaggerated multiplicity of loads which was characteristic of French and Belgian revolving arms up to the close of the century. In this connection there was even a revival of the ancient "superimposed load" device and a certain number of multibarreled pistols of the "Mariette" pattern were produced fitted with barrels designed to take two charges.

There was little or no change in the general construction of the "Mariette" throughout the period of its manufacture, though a fluted cylinder took the place of the separate barrels in some of the later small models. The second specimen illustrated here (Fig. 9) is so equipped and is fitted, in addition, with an ingenious gravity-feed cap magazine in the butt.

To the French nation must go the credit for being the first to apply the principle of breech loading with a metal cartridge to revolving arms of any kind. In 1850, Lefaucheux produced an interesting self-cocking pistol (Fig. 10) which used the newly invented "pin-fire" ammunition. It was loaded by unscrewing the central spindle and removing the cylinder, into the rear end of which the cartridges were inserted. As in the "Mariette", the striker was pivoted under the breech in front of the ring trigger, though in the case of the "Lefaucheux" it struck upwards instead of forwards. Specimens of this new pistol were on view at the Great Exhibition in London (1851) together with the inventor's new breech-loading gun.

The "pepper-box" pistol was produced in large quantities in England and appears to have enjoyed a considerable amount of popularity. A certain number of single-action arms—such as the "Lang" (Fig. 5)—were made, but by far the greater percentage were of the self-cocking type, of which the specimen illustrated in Fig. 11 is a typical example. It will be noticed that it closely resembles the American "Allen" in general design, differing from the latter only in the details of the lock (which is of the "bell-crank" variety), in the fact that the nipples are detachable and in the construction of the nipple guard which is somewhat narrower.

This was virtually the standard pattern as far as England was concerned, and although details of finish and design of the component parts varied considerably, by far the greater proportion of the British output was so manufactured. The barrels were invariably drilled out of a solid cylinder of steel or brass,[7] and one rather peculiar feature was that though a few of the higher grade pistols were fitted with flash shields between the nipples, the majority were devoid of any breech insulation whatsoever. It is difficult to give any definite reason for this omission, but it is possible that the fairly wide spacing of the nipples may have been considered sufficient to minimize the risk of more than one barrel discharging simultaneously. It has been suggested that the nipple insulation feature of Colt's first patent (London, 1835) may have hampered British manufacturers in this respect, but the theory is open to argument.

Safety catches were rarely fitted on American or Continental makes, but a considerable proportion of those of British origin were so equipped. The type most commonly employed consisted of a shallow movable bar set along the top of the breech under the hammer. It could be pressed forward by means of a small knob fastened to its rear end and in this position held the hammer clear of the nipples. Occasionally specimens fitted with belt-hooks are encountered and more rarely still, specimens provided with a small stiletto which can be screwed into the forward end of the spindle in place of the retaining screw. This ingenious addition was, incidentally, incorporated in the original model of the French "Mariette" pistol.

A noticeable feature of the British "pepper-box" pistol output was the wide variation in the grades of finish, which ranged from the cheaply made products of Birmingham wholesale manufacturers to the first-class models made by famous firms of London gunmakers for the more wealthy type of purchaser. Some of the finest of the latter class were made by Rigbys, the famous gunsmiths of London and Dublin. One of their models was equipped with two studs on each side of the breech just behind the nipple-shield, which on being pressed inward allowed the cylinder to be withdrawn and a freshly loaded spare to be slipped into its place. The author has also seen a finely finished model of the same make which embodied a saw-handle butt, a semienclosed hammer very similar to that of the famous "Deane-Adams" revolver, and horizontal nipples.

The only variation from the standard pattern which was manufactured in any quantity in England was the "Cooper" pistol. Joseph Rock Cooper, of Birmingham, appears to have been one of the earlier makers of the self-cocking "pepper-box" pistol in this country. His first patent (No. 8347 of 1840) includes the design of an internal-hammered arm with horizontal nipples and another (more or less of the standard

6. It bears a certain resemblance to the British "Rigby" pistol of the 1830 period. The latter was fitted with from three to six separate screwed-on barrels, the nipples being grouped in circular formation at the breech. These were struck in turn by a hand-rotated eccentric hammer head.

7. Usually about .30- to .36-inch caliber and about 4 inches in length. Heavy specimens up to .50-inch caliber are known, but relatively few appear to have been made.

pattern) designed for use with the detonating-tube type of ignition. He does not appear to have produced either of these in any quantity and by far the best known of his arms (Fig. 12) was a copy of the "Mariette" pistol, differing from the latter in the construction of its barrels which were drilled out of a solid cylinder of metal instead of being made separately. It is said that one or two American manufacturers followed Cooper's example in imitating the design of the "Mariette", and the Milwaukee Museum certainly contains a specimen marked with the name of "Lunt & Sym" of New York. It would be interesting to know if such pistols were actually manufactured in any great quantity in the United States.

By far the most curious type of British origin was the "Budding" pistol (Fig. 13). Little or nothing seems to be known about its inventor, but it is fairly obvious that he was an amateur and not a professional gunsmith. His pistol, from the mechanical point of view, possessed the distinction of being the simplest of any of its type. The barrel cylinder was rotated by hand and locked by a simple internal spring ratchet device. The lock consisted solely of a sprung horizontal striker (mounted internally) with a trigger projecting at right angles from the rear end—somewhat after the fashion of the handle of an ordinary door bolt. It was cocked simply by drawing back the trigger and pressing it sideways at the end of its travel into a small notch cut in the side of the groove in which it moved.

WITH the rapid development and general adoption of the revolver during the 1850-1860 period came the gradual obsolescence of the "pepper-box" pistol. That the latter arm had enjoyed a very considerable popularity is obvious from the large number that have survived to the present day, but it is certainly not easy to name any particular section of the community which favored it especially. There is an almost complete lack of reference to it in the technical and general literature of the period. It is doubtful if it was employed to any extent on active military service [8] and no government ever seriously considered its adoption as an official arm. Nor did it play any noticeable part in British colonial history or in the development of the American frontier, though it is said that the "Allen" pistol was carried by many of the "forty-niners" in the early days of the California gold rush. In fact, it appears to have been a weapon devoid of any definite heroic associations. In all probability it was used mainly as a "house-protection" arm by the citizenry in general and was also carried to some extent by traveling salesmen and other wayfarers in the more isolated sections of the country. The advent of the revolver, a more accurate and far less bulky weapon, did much to decrease the popularity of the "pepper-box" and the middle of the 1850's no doubt saw the gradual but general cessation of its manufacture—as far as the percussion-lock type was concerned.

But the system was not altogether abandoned. Its simplicity of construction gave it a certain advantage as far as manufacturing costs were concerned and the general adoption of metallic ammunition during the 1860's finally solved the problem of flash leakage which had always been present in the muzzle-loading days.

From a little after 1860 up to comparatively recent years there was a steady output of these "fist revolvers" as they were commonly called. The greater part of them were small pocket arms of Continental origin and of second-grade quality. They were usually fitted with self-cocking actions, but a certain number of double-action specimens were produced. Either folding or ring-type triggers were fitted. All the three styles of metal cartridge—pin-fire, rim-fire, and center-fire—were employed and calibers were usually small, rarely exceeding 7- to 9-mm. Fig. 14 shows a typical self-cocking, pin-fire specimen.

A curious variation was the so-called "Apache" pistol (Fig. 15). It was equipped with a folding dagger and its peculiarly designed butt could be folded back and used as a "knuckle-duster". The nearest approach to this weird arm was the American "Bunsen" pistol (it was usually marked "My Friend") which was fitted with a single-action mechanism and which had a very thin round-shaped butt. The latter was pierced with a hole of sufficient size to admit the middle finger of the hand when the cylinder was grasped in the palm and so formed a brass knuckle which, if not quite so deadly as the four fitted on the "Apache" pistol, would certainly be useful enough in a free fight.

The passing of the percussion-lock era in America saw the virtual extinction of the "pepper-box" pistol's manufacture, and the "Bunsen" and the more orthodox "Rupertus" pistols appear to have been the only types produced in any quantity which employed the new metallic ammunition. Both were small pocket weapons of caliber .22.

In England the system seems to have become completely extinct and the author has never been able to trace any breech-loading specimens manufactured in that country.

It is interesting to note, however, that the middle of the 1860's saw a revival of the fixed-barrels, rotating-hammer-head system that was employed in the British "Rigby" and the American "Leonard" pistols. The American single-action, four-barreled, rim-fire "Sharps" and "Starr" pistols were manufactured in considerable quantities (especially the former make) and were widely distributed throughout the world. During the 1880's two English manufacturers—Lancaster, of London, and Braendlin, of Birmingham—produced the four-barreled "Mitrailleuse" pistol which was used to a certain extent by British Army officers in the Sudan War. It was a big, heavy-caliber arm fitted with a self-cocking mechanism and with automatic ejection of the "breakdown" variety. As a rule, special cartridges loaded with heavy slugs, in place of the usual bullet, were used in it. These were found to possess greater man-stopping power at short ranges than the ordinary revolver bullet—a very useful feature in the hand-to-hand fighting of the Sudan campaign.

One of the last and certainly the most peculiar of the "pepper-box" pistols was the "Deadless" which made its appearance in Germany some years before the World War. It was somewhat larger than the average "fist-revolver" and was fitted with four barrels of about caliber .41. Ordinary shot cartridges could be used in it, but it was really designed for use with a special type of nonlethal cartridge which was loaded, in place of a bullet or charge of shot, with a mixture of cayenne pepper, lycopodium powder, aluminum spores, etc. When discharged it emitted a terrific flash and a large quantity of extremely unpleasant smoke, the object being to daze and temporarily asphyxiate the unfortunate person at whom the pistol was aimed. It is hardly necessary to add that its use was infrequent and its popularity was decidedly limited.

8. Except in the American Civil War. The catalogue of the United States Cartridge Co.'s collection illustrates a number picked up on various battlefields. They were probably carried by Southern volunteers at the time when there was a general scarcity of arms in the Confederacy.

Military Motor Transport

The Development and Coördination of Motor-Truck Fleets, I

By Col. Brainerd Taylor*

WARFARE, as waged by Genghis Khan in the early thirteenth century, was warfare of movement developed—with regard to speed and radius of military operations—to the highest degree possible with animal means of transport. Considering Genghis Khan's theater of war with its zones of combat in Europe and in China, and the speed with which he maneuvered comparatively small forces to unfailing victory over many years, it is evident that he understood and counted upon the power of mobility rather than upon the power of other weapons and heavy masses of men and equipment. Ability to ride and care for animals, and skill in their military use in the field on the part of every soldier, from the highest general down to the latest recruit, were the most important individual military requisites of that day. Knowledge of animals, their selection, procurement, organization, operation and maintenance in required numbers and power of mobility, was the most important staff and command requisite. Without the knowledge of how to plan, procure, operate, maintain and replace the power of mobility, with superiority of such knowledge and action at all times over that of the enemy, all other military knowledge and action counted for little in the war planning of Genghis Khan.

Following the history of warfare down through the centuries since the time of Genghis Khan, the soldier who believes in the value of the power of mobility over mass and fire power, views with interest the four years of comparative immobility that characterized the World War on the western front, wherein military forces dug themselves deep into the bowels of the earth and blasted each other with terrific force into mutual exhaustion of national wealth in men and materials. With even greater interest, the student of mobility in military operations studies the mechanized means of mobility of modern times with a conviction that the crux of all war problems and the secret of success in modern warfare rests, as in the days of Genghis Khan, in the ability of every officer and soldier to drive and care for his now mechanical means of movement in the field, and that knowledge of mechanical means of movement in mass, its selection, procurement, organization, operation and maintenance in required numbers and power of mobility, is the most important requisite in staff and command administration.

If the foregoing conclusion is logical, motorization, mechanization, and the mechanical thinking processes that are involved, have become the principal factors in war planning with regard to military operations involving field strategy and tactics, and the reorganization and coördination of all means of mechanized transportation have become the principal factors in grand strategy. In national transportation systems and in those industries which construct and produce modern ways and means of movement, are to be found the most valuable factors in the solution of mobilization and war problems. Prevention of war, and early, cheaply bought victory, if war should come, are promised to that nation among the first-class powers of the world, which develops and maintains superiority in its national transportation systems, coördinated for commerce and war. As a part of this great study, this article deals with the development and coördination of motor-truck fleets. The views herein expressed are the opinions of the author and are not necessarily the views of the War Department.

PAST military motor transport experience relative to vehicle equipment alone, presents a series of cycles, one following the other with a more or less overlapping of the various phases of the cycle. The phases in their natural chronological order are planning, production and procurement, operation, maintenance, and replacement.

The outstanding mistakes of the past, relative to these phases, appear as follows:

In planning equipment to be produced or procured, the planning agencies have failed to consider and coördinate sufficiently all subsequent phases. The essential requirements of maintenance and the great monetary savings possible in replacement have been neglected in an effort to meet the requirements or desires of individual vehicle producers and of every operating agency. The resulting diversification of vehicle types, makes and models and the multiplication of types, makes and models of component units and parts, has been allowed to render practicable maintenance in a prolonged war, and the economical upkeep of the cycle as a whole at all times, impossible of accomplishment. The total cost of the past cycle appears to be exorbitant in comparison with the total cost of a scientifically planned cycle, in which the phases are coördinated within themselves and with every other phase of the cycle. In looking back over the past, it appears that in planning replacement, which is the last phase of a cycle, great savings may be provided for the next succeeding cycle through the benefits of experience. In more concrete terms, vehicle types and models required for contemplated operations may be produced with much greater satisfaction of operating requirements than ever before by planning the vehicle types and models that will be exclusively procured.

While thus planning vehicle types and models required in operations, the essential requirements of maintenance and replacement of vehicles can be provided for by planning the types and models of component units and parts to be used in the production of vehicles planned for procurement. "Red herrings" appear to have been drawn across the paths of recent planning agencies. These scarecrow phrases should be analyzed with greater care than in the past. Such phrases as "high initial costs"; "special military vehicles" versus "standard commercial vehicles"; "danger of stagnation due to standardization"; "upsetting the tooling set-up of the automotive industry if special military vehicles are insisted upon"; "necessity for procuring commercial vehicle types and models

*Commanding Officer, Holabird Quartermaster Depot, Baltimore, Md. Colonel, Quartermaster Corps, U. S. Army.

This discussion presents the personal views of the author and does not necessarily represent official policy on the subject.

that are available upon the outbreak of war"—these and many other catch phrases that suggest but do not express "sound principles" have bothered us all in solving the Army's motor transport problem. In avoiding the mistakes, and consolidating the lessons and benefits of past motor transport experience, many problems in purchasing, operation, maintenance and costs will automatically disappear through greater cooperation and coördination on the part of planning agencies with respect to the entire cycle of motor transport, as viewed by hindsight on the one hand, and by such foresight on the other hand as may be devised.

Quartermaster Corps Experimental Fleet

Vehicles of 1¼ to 10 tons on standard chassis for all arms and services.

IMPORTANT monuments on the horizons of our past and future surveys appear in the following considerations which have been helpful in Quartermaster planning.

Standardization of mechanical equipment and practices has been a pressing need in both commerce and war. In railway transport we have a precedent for principles to be applied to motor transport as well as the illustration of errors to avoid. The existence in the Civil War of at least six different gauges in railroad tracks in the theater of military operations, with no interchangeability between the rolling stock of one road and that of another, and the postwar adoption of a standard gauge is an outstanding example. The beneficial influence of standardization upon commerce and war alike, bringing greater coördination of railway transport, needs no description here.

The standardization of Ordnance equipment, with interchangeability of component parts and ammunition in similar models, sets up a principle in mechanics paraphrased as "interchangeability lock, stock, barrel and bolt." The effect on fire power of simplicity of maintenance in the field, as developed by the Ordnance, points directly to the effect upon the field mobility of armies if the principle of standardization with interchangeability of component units and parts were applied to military motor vehicles. Here again commerce would share the benefits.

The coördination of all mechanical systems of transportation, particularly rail, water, air and highway, is a definite trend since the greatest of all wars, when the need for coordination throughout the theater of war was felt by all nations. The economic chaos in the greatest of all depressions points to the same need. Coördination without standardization is impossible.

In the standardization and coördination of the nation's transportation systems, military experience and influence may be expected and may be found to be as valuable to commerce as it has been in the past in matters of engineering as applied to early rail, water, air and highway transport. In turn, the development of transportation in commerce in times of peace revolutionizes and develops military operations. The fact that the Army exists and works for the benefit and protection of commerce, not for itself, must not be ignored. In considering this military and commercial coöperation, the relation of motorized or mechanized highway transport to the other systems—rail, water and air—is important. Not one of the three last-named systems has the power to reach the points of origin and of destination, where all traffic begins and ends. Because of its unlimited flexibility on land, motor transport alone of all modern mechanized means of transportation enjoys this ability. It therefore holds the undisputed power to collect and distribute the traffic of rail, water and air transport, operating from terminals located along these natural trunk lines. In this service motors have taken over the work of animal transport and of branch-line railways, many thousands of miles of which were necessarily constructed and operated because of the low speed and short daily operating radius of animal transport, a restriction in an otherwise mechanized system that no longer exists.

With the nation at war, the principal collection of military traffic will be performed by commercial motor transport agencies, in the zone of the interior, but the principal distribution of military traffic will be by military motor transport agencies organized as parts of divisions, corps and armies, and of services of supply in the zone of combat. Problems of "continuity of transportation", "coördination" and "standardization" cannot be solved in any one part of this intricate and far-flung national system. Principles of transportation apply equally to commercial and military agencies. The cycle of motor transport in both consists of the same phases; namely, planning, production and procurement, operation, maintenance and replacement.

IN considering demands for motor vehicles which originate in the arms and services, the Quartermaster Corps has been conscious of the force of the law of supply and demand. In time of peace, military demands bear small weight with industry as compared with commercial demands. With the outbreak of war, the situation is suddenly and definitely reversed. If military and commercial demands for motor vehicle equipment appear to be materially divergent, every effort must be exerted in time of peace to coördinate them so as to avoid serious shock when war suddenly breaks upon the nation. Without coördination of the two demands and without the preparation of industry (the single source of automotive supply) to meet the change, inestimable injury may result to public interests since they are bound up in both the economics of industry and in the power of military forces. Military demands and industrial resources are outlined in the two succeeding paragraphs. War-time motor-truck activi-

ties that must be provided for in War Department plans and policies may be classified and outlined as the supply activities and the strategical and tactical movements of military forces by road and highway, and across country where there are no roads.

The military forces of the United States must be supplied, as fast as they can be mobilized and trained, with the field transport which they will require to initiate and maintain their operations. The Army's motor transport must be capable of performing the military transport missions of modern warfare, and it must be possible of maintenance by the Army itself in theaters of operation far removed from the home resources of our automotive industry. Moreover, the character of motor truck activities in the various zones of the theater of war must be considered.

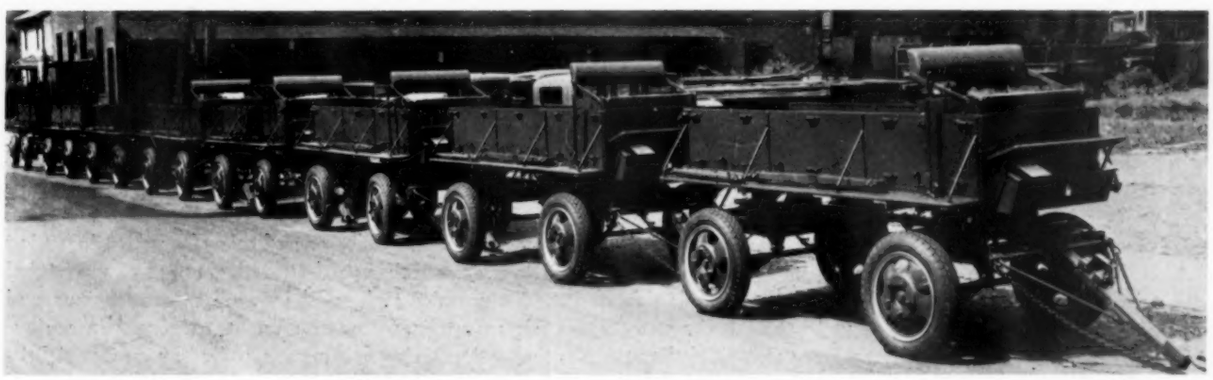
In the zone of the interior—that part of our homeland not part of the theater of military operations—military forces will be mobilized, equipped and trained. The motor equipment immediately required by the various military organizations thus brought into being will obviously have to be provided from whatever types and models are immediately available. Territorial activities of the military services in the zone of the interior may take advantage of existing commercial types and models; reference here is made to post, camp and station transportation, and to the plant equipment of military depots and commercial establishments engaged in war-time operations for the War Department. Although faced with all the problems of motor-truck fleet procurement, operation, maintenance, and costs, to which the principles of planning outlined herein are applicable—as they are to any large commercial fleet management—the situation confronting territorial organizations of the Army is more like that of commercial fleets than the military fleets that operate in and for the mobile units of the Army.

In this connection, available commercial fleets and vehicles of the larger motor-truck and bus companies engaged in common carrier, contract carrier and private transportation should be counted upon as resources for quick procurement and for hire in supply and strategical operations. Government ownership and responsibility for maintaining such vehicles should, however, be avoided. Troop movements by commercial trucks or buses operated by public and contract carriers will undoubtedly be an important war-time activity. Much of this comes under traffic management, a function exercised for the War Department in the office of the Quartermaster General.

In the theater of operations the need for planned, standardized military motor transport will, from the very beginning of modern military operations, be one of the most urgent. If vehicles unsuitable for military service are taken into this theater they should be replaced by required standardized types and models as soon as possible.

In the combat zone, and to a greater extent than ever before in the zone of communications, the field transport of all arms and services will require cross-country ability. Even if a highly developed net of modern highways is found to exist in the zone of combat, hostile modern air and mechanized forces will deem roads congested with transport that cannot operate off the highway too inviting to neglect. The destruction of hard-surfaced roads having high strategical value, regardless of the traffic that may be on them, will be as important as the destruction of railways in past wars. Night operations leading to the close packing of roadways with troop movements by truck, or with the essential supplies moving up to points of distribution, will result in the development of massive targets, too valuable and inviting to be overlooked by any hostile force capable of lighting up a wide area with flares or other means of illumination. Field motor transport that is capable of leaving the hard-surfaced roadways and progressing over poor roads or across country—much as heavy columns of troops develop in the approach march and deploy for combat, thus dissipating the inviting target of massed convoys—will prove to be not only valuable but probably essential in supply and strategical movements. For all tactical operations, cross-country motor transport will be absolutely essential.

EVEN if the rear area of the zone of communications is rendered comparatively safe from attack by the superiority of our combat forces, the hour will come, not once but several times in prolonged military operations, when motor transport will have to be withdrawn from combat organizations and from zone of combat transport, not by vehicles but by entire fleets, for general overhaul and repair. At such times military organizations in the zone of communications will be called upon to surrender a large part of their serviceable vehicles to replace those worn out in the more destructive service of close contact with the enemy. For purposes of reserve field transport then, motor transportation suitable for combat-zone operations should be included in the military motor transport of the zone of communications, and all military



COMBINATION MOTOR- OR ANIMAL-DRAWN TRAILER

For carrying cargo, ammunition, etc., individually or in trains.

motor transport in this zone, according to Quartermaster planning, should be coördinated in standardization planning with the motor transport of the combat zone. For purposes of simplifying automotive supply and repair throughout the theater of war, such coördination is obviously necessary.

In planning for the continuance of national life, commerce and war (in the sense of national defense) are of equal value. One cannot exist without the other, so far as world civilization has thus far developed. Therefore, in planning the procurement of military motor transport to be used and maintained in the theater of operations, the resources of the

Prime Mover, 6-Wheel, 6-Wheel Drive

High-speed transport for divisional and antiaircraft weapons.

automotive industry should be developed to the utmost degree consistent with commercial requirements which the industry must provide for in both peace and war. In this connection, such influence as may be exerted in the direction of prewar coördination of peace-time commercial truck transport production and use with war-time requirements will contribute to the public welfare. The Army is not an isolated section of national life. It is a vital part thereof and closely allied with commerce. As one of the very largest peace-time fleet owners and operators, and by far the largest in war time, the War Department is in a position to develop national defense interests in coördinated transportation as well as general economies in public costs of transportation by the development of military motor transport as an example of the coordinating factor.

This development is to be based upon the fact previously mentioned that motor transport is the only form of mechanized transport that can reach the points of origin and destination upon which all other forms of mechanized transport rely for their traffic. Recognition of motor transport as the principal collecting and distributing agency in a national system of coördinated transportation is essential. The further fact that public interests demand the lowest costs in the operation and maintenance of transport in both peace and war is also to be considered. At this point it is well to repeat the statement that military field motor transport is the nation's latest agency for rapid and voluminous distribution of its military force and power against the enemy. Commercial motor transport, similar to military cross-country types and models, standardized in coördination with good road types and models, if reduced in cost of production and use, will contribute to the opening up of new territories of production and consumption in commerce, as well as to better service in road building, snow clearing, agriculture, forestry and mining, and other activities throughout the entire range of human enterprise now using less competent types of transport.

THE automotive industry of the United States has facilities and capacities for the manufacture and production of military as well as commercial vehicles of all required types and models far beyond all other nations combined. For planning purposes the automotive industry may be classified in five categories in which the various producing and manufacturing companies are currently operating. These five categories, considered in the reverse order of operations—from the completely assembled vehicle back to raw materials—are as follows: 1. Vehicle production. 2. Major component units manufacture. 3. Minor, subunit, parts and accessory manufacture. 4. Semifinished-product manufacture and fabrication. 5. Raw-material production.

Vehicle Production.—This is a vehicle-assembling process only, and almost a pure labor function. The process ranges from the building of a single vehicle by hand to the highly organized assembly plants of the industry, where vehicles in quantity production roll off the assembly line at the rate of one or more every minute. In this process there is no manufacturing machinery involved. In the smaller plants, hand tools only are used. In the more highly developed plants, power tools, traveling tracks, overhead trolleys, and many other mechanical and labor-saving devices are to be found. They are all, with minor exceptions, applicable to the assembling of a wide variety of vehicle types and models.

The process of assembling vehicles is so flexible that the purchaser may specify his own required types and models, utilizing component units and parts of his own choosing. If the purchaser's specifications are limited to units and parts currently handled by the vehicle assembler, the price of his vehicle will naturally be lower, but if the purchaser's requirements justify higher prices that may arise from the use of component units and parts not currently handled by the vehicle assembler, the flexibility that characterizes the vehicle-assembling process may be taken advantage of by the fleet purchaser. Herein lies the opportunity for coördinating the peculiar operating and maintenance requirements of any motor truck fleet, commercial or military. By comprehensive planning, great economy in the cost of motor transport over a period of years may be effected, in which materially higher initial costs are more than offset by a greatly developed power of mobility and by lower operating, maintenance, and replacement costs in the cycles of motor-transport experience.

Major-Unit Production.—In this category lies the key to success in modern commerce and warfare. At no time should reliance for motor transport be allowed to rest wholly on the first category of the automotive industry. The second category is a combination of manufacturing and assembling processes. The problem is essentially one of manufacturing, involving special operators rather than general automotive mechanics' labor. Major units, such as engines, axles, transmissions, and many less complicated assemblies, are produced in various models and in varying volume as required by commercial demand for different types and sizes of vehicles. For the production of such component units the most expensive manufacturing machinery of the industry is involved. Heavy investment in the required tools, jigs, dies, patterns, and other fixtures commits the unit manufacturer to a limited line of engines, axles, transmissions, or whatever units he manufactures, thus producing a degree of inflexibility that is measured by the ratio of his capital investment therein to his total net assets and credit.

With respect to this category, the Government must plan

warily in specifying component major units to be incorporated into its vehicles. So far as available commercial vehicle models are concerned, there are absolute limits as to the number that can be obtained in any one model. Any requirement for a given commercial vehicle model, beyond the capacity of the existing unit-manufacturing machinery, must be met by the slow and expensive process of creating more machines for the increased manufacture of all the units involved in that particular vehicle model. This cumbersome method was used in the World War in producing several commercial vehicle models, adopted by the War Department as standard, and required in numbers far beyond existing commercial manufacturing capacity. The unit-manufacturing capacity of the industry is definitely limited so far as any one commercial vehicle model is concerned, thus forcing the Government to procure in war several models similar in vehicle type and size, but utterly dissimilar in component units and parts. To avoid this situation, which prohibits adequate repair operations, it is possible to design a composite model that can perform the work of several models and that represents the utilization of commercially manufactured units that are in greatest current volume of production, or specially required units the commercial manufacture of which can be readily expanded. As heretofore indicated, such a composite model may be assembled in any plant of the first category, although more easily and cheaply assembled in some plants than in others, according to the practice and assembly-plant set-up of competing companies.

The unit assembly process, like the vehicle assembly process, ranges from a simple hand-tool affair to the highly developed assembly line of the largest unit producers, where traveling belts, overhead trolleys, and other high-speed, volume-producing, and wage-saving devices are used to assemble several hundred, or even several thousand, units per day. In such plants, these unit assembly lines may be flanked by the manufacturing machinery, so that the assembling and manufacturing processes are combined in one more or less inflexible establishment. Furthermore, unit manufacture and assembly may be under the same roof as the vehicle assembly line, thus rendering an otherwise very flexible assembling process more or less inflexible. It is, however, practicable to draw a sharp line between vehicle production and component-unit manufacture, and to direct selected units of the later into the production of any vehicle model required, introducing, if necessary, component units from outside sources, with due consideration to price differentials and the suitability of the vehicle assembling plant for the production of light, medium, and heavy vehicles.

MINOR AND SUBUNITS, PARTS AND ACCESSORY PRODUCTION.—This is chiefly a manufacturing process with such assembling as it requires to produce a minor, or subunit. Here again the process may be under the same roof and a part of the major-unit production process. It is subject, however, to a definite separation and to frequent changes affecting inside and outside sources, thus introducing a flexibility into the process of assembling major units. This category includes the manufacture of nuts, bolts, screws, washers, and the most minute parts of automotive equipment. Furthermore, the capital investment represented in this category is not so great compared to the capital investment involved in the production of major units. It is, therefore, practicable for the Government or for a prospective commercial purchaser of vehicles or major units to stipulate the minor and subunits, parts and accessories it is desired to have used in vehicles or fleets for the production of which he enters into contract.

SEMIFINISHED PRODUCTS.—In this category, canvas, rubber and leather goods, castings, sheets and forgings, paints and alloys, and many other fabrics and semifinished goods peculiar to the automotive industry and common to many industries are produced. Where there is heavy capital investment in manufacturing machinery pertaining to this category, the use of the products is usually widespread in many industries other than automotive. The problem of planning the conversion of automotive industrial resources into the production of military motor transport includes consideration of general munitions requirements and the war-time automotive requirements of the civilian population. The necessity for utilizing part of the machinery and part of the products of the fourth category for other defense and for civilian needs will permit of an equitable division of the fourth category to meet the military automotive requirements of Quartermaster planning and all other requirements without any serious retooling.

RAW-MATERIAL PRODUCTION.—We now turn to the mines, fields and forests where required metal, mineral, agricultural, and other natural commodities are produced. The problem of allocating these basic materials to provide for the various commercial and military requirements of war-time activities and consumption is involved. No change in the problem of allocating raw materials in war time is introduced by Quartermaster planning, as outlined in this article, other than in directing the flow of materials to be used in production of motor vehicles for the Army through the plants of fourth, third and second categories, so as to produce military types and models of vehicles specified by the Government rather than commercial models that are not planned to meet military requirements. Fundamentally, the Government must direct and guarantee the volume and rate of flow of materials from this fifth category through all the other categories to produce vehicles that represent strictly commercial vehicle models, if it awards large contracts for such vehicles; otherwise the vehicle producers cannot meet their contracts on time or in required numbers. The Government might just as well direct this flow through existing plants of the several categories in order to produce the vehicle types and models it requires and therefore specifies, utilizing existing manufacturing facilities that harmonize with its war-time motor transport plans.

In the study and analysis of the various commercial organizations that go to make up the automotive industry, classification and use of the vast number of companies included in the industry appears to be difficult because some are found to be operating in two or more of the five categories outlined above, while others specialize and operate only in one. In mobilizing the automotive industry of the United States, the great flexibility and capacity of the industry as a whole—if handled with the categorical conception of the processes involved, as indicated above—provides the nation, through Government or War Department direction, a means of developing a war-time mobility in the field that no other nation, or group of nations, can even approximate, so long as the automotive industry of the United States holds its present position of leadership. This position of leadership, and possibly the future existence of our automotive industry, depends, however, upon coördination of national transportation systems, which cannot be accomplished without further automotive standardization. (*To be concluded in the next issue.*)

Machining Aluminum

The Metal and Its Alloys in Ordnance Production

By T. R. Taber*

ALUMINUM and its alloys are being used increasingly in ordnance manufacture, and with increased use the economical machining of aluminum parts has presented a growing problem. A good deal of peace-time production is in such lot sizes that it rarely pays to introduce machinery and methods for the *most* economical production of a particular part, but the plant making even small lots of aluminum parts cannot reasonably disregard recent advances in the industry, nor fail to adopt the basic principles of correct machining.

The following paragraphs are based on current trade literature, supplemented by considerable practical experimentation in active Ordnance establishments. The ideas here expressed have, in general, passed through and beyond the revolutionary stage, and can be utilized by any shop to an extent depending upon the amount of aluminum work in hand.

All departures from general machine-shop practice in the case of operations on aluminum, are in the direction of woodworking technique. As in woodworking, very high speeds are possible, and in most cases indicated. Cutting tools, as in woodworking, should be ground with extreme top rake, giving a shaving action. The disastrous effect of chips allowed to remain in woodworking cutters is paralleled and even surpassed by the action of aluminum chips on the parent metal.

The prompt removal of chips from the vicinity of the cutting edges of aluminum-working tools is of the utmost importance, and should be accomplished by thin, smooth, keen edges producing a noncurling, nonadhesive cutting, conducted away from the work, preferably by force. Rough work from a properly ground tool can invariably be attributed either to an adhesion at the cutting edge or to chips lodged between cutter and work.

In general, cutting speeds with the best cutters need not be reduced for the harder alloys of aluminum, due to greater ease of removing a uniform, bright-backed chip from this material. Alloys showing high elongations, however, may be expected to require considerable attention. It is generally true that the higher speeds and lighter feeds give the lowest tool pressures and coolest work, though tool-life considerations may cause departure from this rule for roughing cuts only. (On long roughing runs, it may be advisable to save a proportion of passes through the hard surface skin of castings by lowering the speed and increasing the feed, but on finish cuts a higher speed at reduced feed gives best results in every case.) Modern tools for aluminum will stand cutting speeds up to 1500 feet per minute for all operations within the limitations of the machine, except drilling and thread cutting.

Roughing operations, when the shape of the casting permits, should be confined to a single cut, but the finish cut, for best results, should be kept very thin (.003-inch to .005-inch). Finishing feeds should, except in planing, be kept down to .002-inch to .004-inch per pass of each cutting edge, but with the cutting speeds possible, considerable feeds per minute will result.

A liberal flow of coolant assists in all aluminum operations. The principal hindrance in short-run work is inability to direct and confine the stream, due to cutting speed. The coolant should be flowed on whenever feasible, however. The coolant to use must be determined by considerations of effectiveness in cooling the work and keeping cutting edges clear of adhesions and cuttings, preservation of the machine, and future operations on the work. Light petroleum products, such as kerosene and fuel oil, give good results, but may damage the machine. Proprietary cutting oils diluted with water or paraffin diluent are satisfactory if used in low concentrations such as will not either rust machinery or gum moving parts. The use of paraffin-diluted oils is not generally recommended for aluminum, but is very convenient for short-run work, especially if the coolant must be brushed on. Coolants with high lubricating properties are detrimental to finish, and high covering qualities are essential in the coolant chosen.

Hard-tipped tools give high performance in tool life and finish obtained, if ground in forms approximating those recommended for high-speed steel. So-called "general-purpose" hard-tipped tools have only the advantage of a lasting keen edge and none of the added advantage obtainable by using extreme rake. Due to the very low tool pressures in correct machining of aluminum, however, the usual heavy support for hard tips is not a primary requirement, and all manufacturing establishments can profitably provide special tools for aluminum to at least some extent. Proper brazing, grinding, and lapping technique must be stressed in view of the tool forms advocated, but this is not an unusual requirement, as only the best practice in these particulars will pay in *any* use of hard-tipped tools. Ready-made tools of the type recommended are not catalogued at present, but tips molded for application at various degrees of rake are obtainable in tungsten and tantalum carbides and in Stellite J-metal, or the complete tools may be ordered as specials.

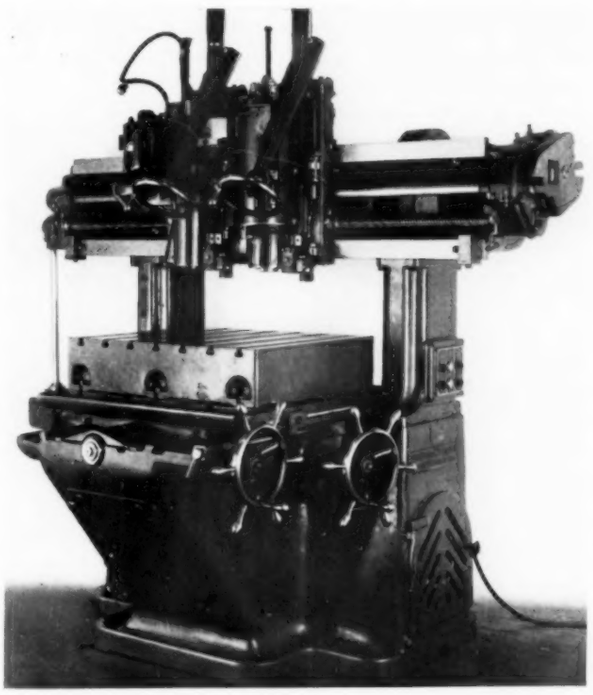
All aluminum tools will cut better if the entering edge is beveled back from the direction of cut, and best if the bevel extends out of the cut. The effectiveness of the bevel, as compared to a radius, lies in avoidance of a double bend in the chip combined with wide distribution of cutting effort. The angle of the bevel may be adjusted to vary tool pressure. The "top" surface of the tool should clear the work except at the leading edge, although a narrow land in contact with the work is desirable for fine finish.

GENERAL technique may be followed in milling operations, but difficulty is at times experienced in two particulars. With small cutters, especially in older machines, it may be difficult or impossible to obtain the proper cutting speed, and if the proper speed is available, there is still difficulty in di-

*Formerly of Frankford Arsenal; now stationed at Fort Sill, Okla. Captain, Ordnance Department, U. S. Army.

recting and confining a copious flow of coolant. The latter difficulty is of course correctable by installing shields about the work, but if the run is short, brush application is required. In either case at least a makeshift shield is indicated, due to the shower of chips thrown from a heart-warming job.

As pointed out above, none but comparatively modern milling machines are ideal for aluminum if small cutters are used, and even the most modern standard general-purpose machines do not have adequate spindle speeds for cutters under two inches in diameter. The high-speed accessory attachments available at present give speeds up to 5000 r.p.m. (higher if ordered special), and these attachments should be used for all very small cutters, but are not recommended in their present form for cutters over about ¾-inch in diameter. Full cognizance must be taken of the inability of most manufacturers of ordnance to furnish a great deal of machinery for the sole purpose of performing aluminum operations, so that cutters between three-quarters of an inch and two inches are ordinarily the most difficult to speed properly. This gap can of course be closed by specially built machinery, an example of which is shown in the center of this page.



COMBINATION VERTICAL MILLER AND PROFILER

This machine, a combination vertical miller and profiler by Pratt and Whitney, is basically capable, using the standard head, of milling all materials and performing the usual profiling operations. For the smaller cutters in aluminum, however, a separately powered head is provided, with speeds from 1000 to 6900 r.p.m. The second head can be operated in parallel with the main head vertically and transversely, or it can be operated separately over the entire range of the machine, permitting an unusual range of profiling operations, as well as being ideally adapted to aluminum spot-facing and surfacing. It should be noted that all feeds are by turnstile through multiple-lead screws. Moving parts have adequate inertia but movements are facilitated by unique antifriction devices, adjustable to table loading.

Other milling machines, of the Universal type, with built-in auxiliary spindles are beginning to appear, and if adequately speeded and powered, will materially help to close the present gap in equipment.

Ease of manipulation is desirable, and special machinery can be built to include this feature, using hand feeds. Standard general-purpose machines, however, if possessing the desired range, are heavier than necessary for aluminum or other light operations. This need not bar the standard machine if the speeds and feeds are adequate and full advantage is taken of the power rapid traverses and handy controls now being provided on so much of the equipment of latest design.

The subject of cutters is an important one, but cannot be given full justice here. If standard cutters are used, the general requirements for aluminum should be followed as closely as possible. This is accomplished by choosing from available cutters those having: 1. Fewest teeth, giving large chip clearance; 2. Undercut teeth and (end mills) spiral cut in direction of rotation giving maximum rake; 3. Hard tips, if other requirements are filled. The only good advice concerning old cutters is that they be scrapped, recut if possible (probably with half the original number of teeth), or used on something else. Honing improves all cutters. Some of the best aluminum practice occurs in facing and surfacing, using end mills up to 1½ inches, and face mills above that diameter. Standard inserted-tooth mills, if used, should embody the features listed above, and will usually function best with every other tooth removed or backed off.

INSERTED teeth can be given increased rake in both directions by special lip grinding. But the best face mill is a special one which can be made in the shop. This cutter is a cylindrical block with a few bits inserted at an angle to both the diameter and the axis, and protruding nearly to the chattering point. This cutter may remind the user of a tarantula about to spring, but removes aluminum with amazing ease and expedition. The bits may be set with edges at twenty or more degrees with the diameter, and the angle with the axis is limited with various sizes by the hole spacing. Up to 4-inch diameter, three or four teeth are sufficient, and for diameters from four to twelve inches, one tooth per inch of diameter is sufficient.

All end mills and face mills should be ground with two to three degrees relief from the center nearly to the outer edge of the tooth. A narrow flat land should contact the work, and the entering edge will function best if beveled and furnished with a slight stoned lead to the land mentioned previously. The bevel is quite important, and should preferably extend out of the deepest usual cut, but the necessity of milling to sharp corners on some jobs may limit the application of this principle.

Plain mills for slabbing should be used only where an end mill or face mill will not do; for example, when a cut ends in a radius. However, if used, the steepest spiral cut available will give best results, in conjunction with large chip clearance and undercut teeth. Chip-breaker cuts are desirable on wide mills for the reduction of chatter, and interlocking mills with alternately reversing spirals accomplish the same purpose.

Side mills or slotting cutters in the narrower widths should

have staggered teeth for best results. These are happily available standards, as are interlocking cutters giving the desired rake on both sides of the cut. Half-side mills should of course be chosen with spiral cut in direction of rotation.

Although the maximum cutting speed is difficult of attainment with standard boring machinery, it can be approximated by making full use of other equipment for the smaller holes. Where large range is needed, a boring mill must be employed. Spindle speeds have recently been increased for these machines, and auxiliary high-speed spindles are beginning to appear. These, however, are limited in depth range. The smaller boring jobs can be done in the milling machine, drill press, lathe, or bench lathe, depending upon size of work, size and depth of hole, and accuracy.

Cored holes may be roughed with a multiple-blade head similar to the special face mill described previously. Single-point tools will perform very nicely if set in accordance with general aluminum practice, but opposed blades will do better, especially if the boring bar has no outboard support. In any case, boring bars of alloy steel are a paying investment, as they offer maximum rigidity in diameters providing adequate chip clearance. If standard flat blades are used, their performance is immensely improved by special grinding with rake toward the entering edge and with a deep smoothly curved lip, not forgetting the bevel if possible. A slight back clearance from a narrow full-diameter land at the entering edge helps to keep the hole clean.

PRESENT general equipment for turning is more than adequate for aluminum work in every way except as to speed. The bench lathe alone offers an approximation of the proper speeds for small work, and though this machine should not be despised as a production tool, it is rarely satisfactory for any but the lightest work. Automatic screw machines, of course, are capable of high spindle speeds, but tooling costs exceed operating savings on short runs.

In turning operations, full use may be made, however, of the high rake angles advocated. Tools with fifty degrees or more of rake in the direction of cut give excellent results if properly prepared. Tool bits held at a sharp angle with the holder lend themselves best to this type of grinding.

The basic principles laid down for other operations should be followed for turning, especially as regards avoidance of a pronounced curve on the cutting edge. A straight or nearly straight edge at about forty-five degrees with the direction of cut gives least trouble from adhering metal. A flat end surface tangent to the work at the side-rake angle improves the surface. This is especially true for the finishing cut, provided the cut is sufficiently thin so that only the center portion of the end surface, contacting the cylindrical surface of the work, enters the cut.

The extreme forward rake is obtained in two ways: either by actually grinding the tool to the desired rake and using at center height, or by grinding to a lesser angle and using above center. As should be expected, the latter procedure should be used only for light uniform cuts to avoid gouging. Chatter can be controlled by adjustment of depth of cut and/or width of tool-nose in contact with the work.

In order to support the tool edge as well as possible, and at the same time use high rake angles, it is advisable to keep the clearance at a minimum. Three or four degrees are sufficient, if adequate speed is available and correspondingly low feeds per revolution are employed during the operation.

Although much work is being removed from planers, shaper-planers, and shapers to milling machines, there are still many operations performed in planing machinery. Even the fastest mechanical and hydraulic machines of this type afford maximum cutting speeds far below those desired from a cutting viewpoint, but the ideal tool form can often be used, with high rake, minimum clearance, and straight or nearly straight entering edge held at an obtuse angle with the surface of the work. A long straight chip flowing smoothly from the tool is the result sought for. Scores on the back of the chip indicate inadequate honing of the tool and the early appearance of roughness in the work, due to metal clinging to the cutting edge.

Finishing tools for surfaces with clearance all around may be shaped similarly to the square-nosed tool for finishing cast iron but ground with high rake and set with 45-degree skew. The bottom should be slightly rounded and should *not* cut across the entire width of the tool. Feed and depth of cut should be adjusted to prevent chatter, though the feed may be quite coarse (up to one-half of tool width) if the depth of cut is kept low.

Drilling machinery for all-around use has been vastly improved, but here again the advantages are all in favor of the small sensitive machines which are commonly obtainable with spindle speeds up to 10,000 r.p.m. and better.

If the holes are deep, the speed need not be reduced greatly, but a fine feed is essential, with frequent complete withdrawals for flushing. Returning to the hole, the drill must not "bump" the bottom, as this bump raises a thick chip which may cause great trouble. In fact, most deep-hole drilling troubles occur in this way, and automatic machines for this purpose employ electrical or hydraulic means to stop the return rapid traverse just before the drill bottoms, so that the drill re-enters the cut only at the feed angle. Hand deep-drilling processes should approximate the same procedure.

AS previously indicated, the foregoing is not intended as a text for high production of aluminum parts for which ideal machinery can be individually designed, but is intended to outline the application of certain basic principles to the various operations performed on the general-purpose machinery with which establishments for the manufacture of ordnance are largely equipped. The extent to which these principles can be, and are, applied by large manufacturers of aluminum parts barely has been indicated.

Neither is it intended to put forth any reactionary doctrine. Much of the material for this article was derived from the writer's observation of processes in important American manufactories of ordnance matériel, to whose courteous staffs acknowledgment is hereby rendered. The remainder, for which the writer assumes responsibility, but for which any possible credit is due his immediate superiors who made the research possible, is submitted only for what it may be worth for the improvement of ordnance processes.

Inquisitiveness is progress, though the road be rough. The writer feels that the field is sufficiently new so that some shop men will doubt the principles stated herein, or their application to their own problems. Many have doubtless been upbraided, in apprentice days, for doing some of the things here advocated. If, therefore, no more than a doubt has been planted, this effort by the author will have been justified.

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Month by Month

MAJ. GEN. WILLIAM H. TSCHAPPAT, Chief of Ordnance, writing in a recent issue of the *Army and Navy Journal,* presented an informative analysis entitled "Spending the Ordnance Dollar". The subject is one on which there is a great deal of misunderstanding. General Tschappat's discussion scotches—or should scotch—very beautifully the belief that public funds appropriated for military armament go into the hands of "greedy munitions makers".

SPENDING THE ORDNANCE DOLLAR

For years it has been understood that approximately eighty-five cents of every dollar appropriated by the United States for the manufacture of military and naval equipment is spent for labor. We have never seen a break-down quite as succinct as the Chief of Ordnance gives of this eighty-five per cent, and for the information of our readers and with acknowledgment to the *Journal* we publish the following from General Tschappat's discussion:

"The carrying out of this work (ordnance manufacture) is primarily in the hands of the manufacturing arsenals, which spend some nine million dollars per year for steel, brass and other metals; for machine tools and small tools; for instruments of all sorts; for paints, varnishes and lubricants; for electric power and for fuel; for chemicals, rubber, textiles and lumber; for motor vehicles and their components. Not only is the labor part of the Ordnance dollar given wide geographical distribution, but the material part of the Ordnance dollar is spent in many industries over most of the country. Since there are many small purchases and since all purchasing is by free competitive bidding against specifications, the material part of the Ordnance dollar flows quickly and widely into industry.

"Rather than continue these generalizations, a study of a particular weapon may be of more interest, say a typical fighting tank. The money spent for such a tank is divided approximately as follows: For armor plate, 20 per cent; procured from civil steel plants. For engines, 12½ per cent; procured from civil engine manufacturers. For transmission and final-drive units, 5 per cent; procured from civil machine shops. For accessories, 2½ per cent; procured from civil manufacturers. For guns, 10 per cent; procured from civil manufacturers. For raw materials and small parts, 25 per cent; procured from civil sources. For arsenal labor and overhead, 25 per cent; (wages spent in the community in which arsenal is located).

"Since most of the money paid the civil purveyors goes for labor, a tank can be seen to furnish much employment. It is estimated that a $25,000 tank furnishes the equivalent of work for ten men for a year, of which only about two men are arsenal civil employees and eight are in private employment.

"The major components of a tank involve direct purchases from not less than twenty-five manufacturers; in one case these manufacturers were located from Connecticut to Wisconsin; from Michigan to the District of Columbia. The raw materials for these factories came, of course, from much wider sources.

"As it is for a tank, so it is, more or less, for any other item of ordnance: most of the money paid for it goes for civil labor and a large part of the money is spent in purchases from American manufacturers and business men. The Ordnance Department, military in name and control, is actually a large and important industry operated seventy-five per cent by civilians of many hundred occupations, who are located wherever the American flag flies. Finally, this ordnance "industry" manufactures weapons in its Government-owned factories only where economical or otherwise in the interest of the United States; beyond this it is a good customer to hundreds of firms ranging from the heaviest to the lightest industry. Thus, while preparing the Army for future war, the money appropriated by Congress for Ordnance furnishes present employment to labor and present orders to business."

THE Army Industrial College—that citadel of industrial mobilization research—has achieved many notable successes since its establishment in February, 1924. Its administration, faculty, curriculum, and the performance of its graduates—all have been instrumental in bringing this unique institution to its present importance. Many notable speakers have addressed the College. These discourses are a veritable encyclopedia of industrial-preparedness doctrine. The latest text in this historic collection is the address of Gen. Malin Craig, Chief of Staff of the Army, who spoke to the fifty-two graduates—officers of the Army, Navy and Marine Corps—at the exercises held at the close of the 1935-1936 course.

WHERE MILITARY AND INDUSTRIAL PROBLEMS MEET

The following excerpts from General Craig's address can be taken to heart by every proponent of industrial preparedness:

"A future war may be very different (from the World War). Rapid movement may replace relative inaction. The combat zone may be vastly enlarged. Certainly the trend in modern weapons and means of transportation indicates that an increase in mobility and fire power may be expected. This means that we may anticipate the necessity for procuring a somewhat different type and quantity of supplies and of

issuing them to flying columns of troops from mobile bases. The rapid advance in aërial warfare, with much greater speed and range of aircraft, means that we must be prepared for aërial raids on supply establishments far behind the lines. All this complicates tremendously the already difficult problems of the staff officers charged with supplying the troops. The strategy pursued will have a profound influence on the supply situation.

"Because we will likely have a different situation in the future than in the past is not a reason for ignoring the past. Our experience in former wars should be studied and intelligently applied. A sufficient time has now elapsed to enable us to view the stirring events of the World War with the proper perspective. Much that happened then has passed from the realm of acrimonious debate to that of historical research. We are able to review calmly the causes of the errors, the delays and the difficulties of that period as well as the reasons for the ultimate success that attended the great American effort in the World War. In doing so we have no purpose save that of profiting by that experience with a view to overcoming obstacles that may be encountered in a future struggle if war should unhappily again come to America.

"We entered the World War with little conception of the military and industrial effort that would be required. The people of all walks of life firmly supported the Government and patriotically pledged their services. We had the greatest amount of difficulty in determining our requirements. We were unable to give to industry a clear picture of our probable military needs. Industry and commerce found it difficult to make the adjustment necessary. We were without experience in a modern war of major proportions and our supply problems were tremendous. That they were satisfactorily solved, though with considerable delay, is due in very large measure to the splendid work of the War Industries Board, which has been the subject of much study at this college.

"From the World War we learned that we must first determine our requirements, the priority of our fields, and then the availability of materials necessary for the fabrication of our military supplies. A complete knowledge of these factors necessitates a thorough understanding of sources of production, foreign trade, transportation, power, fuel, labor, and a host of other elements that enter directly into the broad question of procuring supplies for the Army. By the very nature of his profession the Army officer is seldom an advanced student of economics. It seems a far cry from the parade ground to a study of the principles of economics. Nevertheless there must be some of our officers, particularly those of the supply branches, with a thorough grasp of such questions. The best place in the Army to acquire this specialized knowledge is at this school. Here military and industrial problems meet.

"The knowledge acquired here is of tremendous value to the officer and to the Army both in peace and in war. Procurement activities in peace are necessarily circumscribed by regulations which have for their purpose the assurance that the Government will receive the best quality at the lowest possible price. In war these considerations are likewise important but time is the great pressing factor. In a battle it is better to secure inferior and expensive products on time than to receive a high-quality, economically priced product too late. When war comes we must fight. Plans for fighting must be made in peace, if at all. Similarly our procurement planning must be done when the country is at peace, else in a future struggle we may have the same confusion and delays that hampered our effort in the World War."

Gas Defense

A THOUGHT-PROVOKING paragraph appeared in a recent issue of the British *Army, Navy and Air Force Gazette* entitled "Our Gas Defense Crisis". It is unnecessary here to go into the details of this crisis. We are more concerned with the philosophy which may have brought it about in Great Britain, because that philosophy is at the root of all military organization, our own included. It is well for all of us to look conditions squarely in the face.

If memory serves correctly, it was our distinguished contributor, Maj. Gen. J. F. C. Fuller, in one of his books, who quoted a conversation he had just after the World War with an officer of high rank in that conflict. The officer said with every sign of pleasure: "Now that this beastly war is over we can do some real soldiering". The expression apparently epitomizes what too many military minds have been doing about gas warfare. It would seem that this new branch of combat has been neglected more than a reasonable man would have supposed. We cite the incident because it indicates how easily the mind reverts to experience. And few of us are immune. We publicly here confess that the tendency is very captivating.

It is difficult to doubt that gas will be used in abundance in another war. And it will probably be used immediately on the outbreak of that war. Such seems to be the indicated fact although we do not subscribe to the hallucination that the use of gas can or will wipe out entire populations, destroy humanity generally or to any of the other wild-eyed, grotesque pictures painted so generally these days. The fact is that nobody with a realistic mind can look back on the last twenty-odd years and place much faith in treaties, leagues, agreements, protocols, and such other ways nations have of giving lip service to peace. With no disparagement of that very large and very respectable body of opinion which most earnestly and sincerely wants peace, it appears that in the final analysis every strong nation must put its own preservation ahead of peace. From the strictly moral point of view this should not be so, but alas, in the world of reality, it is so.

Aircraft, submarines, gas, tanks, and all the other newcomers in the field of combat will be used in another war. That is certain because in war utilization is made of every scientific advancement of the preceding peace. Therefore any failure on the part of military men whether in Great Britain, the United States or elsewhere, thoroughly to study and prepare for the offensive and defensive use of the new agencies would be negligence bordering on the criminal.

We have an obligation and a duty to cull from the military past all that it has of value—and it has a tremendous amount. But there is also the very definite obligation to go forward. The past should be made of record and studied intimately. Armies and navies are very conservative organizations and when they give too much attention to the past and too little to the future then crises will develop. At least a progressive policy has the merit of bringing the crisis to attention while "soldiering." Looking to the future whether on land, sea, or in the air, whether with gas, aircraft, artillery, or rifle, is the only way to meet the pressing obligation of national security

Nationalization of Munitions, III—Why?

An Editorial

IN the two preceding issues of this Journal we have published in this place a study of several phases of the current proposal for the nationalization of armament production. In the first of this series of editorials the views and opinions of recognized authorities were brought together. These presented the judgment of men who have given the question serious, impartial thought and who have had actual experience, both in peace and war, in solving the munitions problem. Beginning with the Kernan Board in 1916 and during the twenty intervening years, no qualified expert on this phase of our national defense has proposed the prohibition of the private manufacture of arms.

In the second editorial of this series we analyzed other factors in the nationalization proposal and called attention at some length to the very wise steps already adopted in our own country and similar strides now being taken by Great Britain for mobilizing industrial strength in conformity with national defense needs. A British White Paper outlined the plans which are now in effect; it placed great stress on the utilization of private industrial facilities by way of what we know as "educational orders". We also cited some opinion from the American press as to the validity of nationalization in the United States and we found quite unanimous agreement in opposition to the proposal.

In this concluding phase of our study, we intend to discuss the report of the majority of the Senate Committee for the Investigation of the Munitions Industry. The Committee majority—Senators Nye, Clark, Pope, and Bone—recommended the abolition of private manufacture of armament to meet the needs of our military and naval forces in peace. The majority report states that it "recommends Government ownership of facilities adequate for the construction of all warships by the United States Navy Department, also all gun forgings, projectiles and armor plate and of facilities adequate for the production of powder, rifles, pistols and machine guns necessary for the United States War Department". The majority further held that it believes "that the War and Navy Departments can produce from their own ranks or employ sufficiently able technicians to operate these plants successfully". And further, "that the mobilization of the war-munitions industries in war time for the war-time production of some or all of the necessary munitions can be carried out in the same way it is now proposed to do". Next, the majority exempts the aircraft industry from Government ownership, although "it is almost entirely dependent on Government orders or indirect subsidies, because airplane and engine construction is still a rapidly developing art and in that way different from the somewhat more standard articles for which it is proposed to have the Government acquire facilities". The majority further recommends "that the War Department be given sufficient appropriations to acquire the jigs, tools and dies necessary for installation in private plants in time of war for the manufacture of munitions". The final recommendation of the majority urges "strict control both in regard to profits and foreign and domestic activities for those parts of the industry not included in Government ownership."

The Committee minority consisted of Senators George, Vandenberg, and Barbour. The minority opposed the complete nationalization of certain defense commodities "because it doubts the advantage from the standpoint of (1) its effect upon disarmament, (2) its effect upon essential national defense, and (3) its effect upon Government costs". The minority stated: "The committee minority believes that if large Government plants are erected to provide these commodities, there will be inevitable local, political pressure to maintain these plants at full-capacity production regardless of actual defense needs, and the result will be to encourage armament rather than disarmament. The committee minority believes that if all production be thus concentrated in Government plants, furthermore, there will be no adequate corollary reliance, through private manufacture, in the event of a war emergency unless the nationalized facilities are maintained at a needlessly extravagant and dangerous rate during peace time. The committee minority believes, on the other hand, that unless these facilities are kept on a full-time production basis during peace years, the unit cost of production will increase to a point which will create higher costs to the Government than would be available through normal, private purchase. This could be another impulse to armament rather than disarmament through anxiety to maintain maximum arms production in order to maintain minimum costs.

"In other words, the committee minority believes that the public welfare, from the standpoint of peace, defense and economy, can be better served by rigid and conclusive munitions control than by nationalization except in a few isolated instances."

THE minority views are entirely justified; the majority views are not. This was to be expected. Certain members of the majority for the past few years have been going up and down the country stressing the evils of private munitions manufacture. Some have indulged more in invective than in fact. In passing, we call attention to such tactics because the Committee was appointed to "investigate". It is quite bad enough when a so-called investigating body is judge, jury, and prosecuting attorney all in one; it is in the nature of a racket when an investigator, in the midst of his work, seizes the opportunity to indict publicly, regardless of the type of evidence on which the indictment is based, the fishing expeditions by which the evidence is procured, the sincerity of those who seize such evidence and the *ex-parte* interpretation they place upon it. The files of the Army Ordnance Association and the personal correspondence of the writer of these lines having been ransacked by agents of the Nye Committee, we know whereof we speak. But such tactics are perfectly apparent, we believe, to everyone these days.

Leaving aside all questions of committee procedure, personal bias and other practices common to most politics and many politicians, we make the following observations on the nationalization proposal of the majority of the Committee. We do so because it is understood that an intensive campaign will be engaged in during the coming months by proponents of nationalization looking toward the adoption of laws in furtherance of Government ownership of arms-making facilities. It will be well if our people who are not familiar with elementary ramifications keep certain simplicities in mind.

OUR first observation relates to the proposal in its broad outline. In other words, the proposition is that we should have Government ownership of facilities adequate for the construction of all warships, gun forgings, projectiles, armor plate, powder, rifles, pistols, and machine guns. We respectfully ask, why Government ownership? What is there in the nature of these things which calls for Government ownership of production facilities? Can it be that these inanimate things and their private production are the cause of war? A child can answer that they are not. As we have said time and time again in these pages, and as every thinking person must agree, arms are not a prime cause of war in any sense of the term. The causes of war are far deeper. They go back to basic ideas and ideals. They are lodged in the will to live and to prosper. They have to do with the economics of populations, the need for land and minerals and food, the impulse for trade and fair dealing and national hegemony, the variations of climate and natural resources, age-old differences of opinion, concepts of morality, bases of culture and religion. To say that inanimate armament is a cause of war is a sure indication that the one who makes the declaration is so naïve that he cannot distinguish between a cause and an effect.

These things for which we would have Government ownership of production facilities under the above recommendation, are *some* of the implements of national defense but they are by no means all. Armies and navies are equally dependent on so many other things for their efficiency and effectiveness that all the pages in this issue of this Journal would be required to catalogue them. Let us select just three at random and ask why they are not included in the proposal. The first has to do with the personal welfare of man, the fighting unit, so let us suggest bread, as an example. What about bread? Just this. Armies and navies can fight, as for centuries they have fought, without warships, gun forgings, projectiles, armor plate, powder, rifles, pistols, and machine guns, but none of them has ever fought without bread. Napoleon put it, "An army travels on its stomach". It did in the time of Napoleon, of Alexander the Great, of Hannibal, of Caesar, and of the Ptolemies. It did in days of Grant and Lee, of Bismarck, of Miles, and of Allenby, Foch and Pershing. It does today. One is reasonably safe in predicting that armies and navies will continue to move on their stomachs until campaigns are waged only between good and evil spirits. Of what value armor plate to an army if there be no bread? Or of what value powder, whether wet or dry, if there be no meal? So in this category we urge in all seriousness that international peace and domestic tranquility will be the better guarded if we have Government ownership of "adequate" facilities for the production of bread, the growing of wheat, the impounding of water, the mining of salt and the cultivation of yeast. Likewise there should be a licensing system invoked requiring visé and diplomatic approval for the exportation of bread as a finished product and for any and all of its component elements! Absurd—but logical if the premise is correct.

The second example of the simple things armies must have in addition to armament has to do with the organizational welfare of the military unit. So let us suggest the now common-place automobile truck, or if you are old fashioned, the horse and wagon. What about these means of transport? Just this. Armies and navies can fight, as for centuries they have fought in the very bloodiest kind of fighting, without warships, gun forgings, projectiles, armor plate, powder, rifles, pistols, and machine guns, but none of them has ever fought without some form of transport in addition to "Shank's mare". Means of transportation both for the movement of men and, more important, for the movement of supplies, are as vital to an army as any element of its composition. It has ever been so and always will be. Therefore if the purpose of this Government-ownership proposal is to guarantee peace and make armies self-sustaining we should have Government ownership of sufficient ranches and stables for the breeding of horses and mules; of forests and mills, and wheelwright shops for the making of wagons, and of mines, factories and laboratories required for the production either of parts or finished items in the great automotive industry producing our passenger cars, trucks and buses. Let these good people who propose nationalization not forget that it was the lowly taxicab that saved Paris in 1914 just as it was cavalry—man and the brute beast—that saved any number of causes and places on thousands of occasions in days gone by.

THE third example we suggest has to do with something fairly new; namely air power. What about aircraft? On this point the majority of the Senate Committee is indeed naïve. When the four members of the majority signed this portion of the nationalization report there must have been four individual tongues in four respective cheeks! "The aircraft industry", said the majority, "is at present exempted from these recommendations (for nationalization) . . . . because airplane and engine construction is still a rapidly developing art". The statement is correct in its entirety and is the soundest pronouncement that could be made. The Senate Munitions Committee spent more than $190,000 of the taxpayer's money to carry on its long drawn-out job and it gave us this perfectly obvious truth as a result! But the inferences of the statement are most amusing; the inferences are the reasons why tongues were in cheeks. As we read what the Committee says, we think the inference is justified that the construction of warships, gun forgings, projectiles, armor plate, powder, rifles, and machine guns being, as the Committee says, "somewhat more standard articles" that development in these fields has reached a saturation point and there are no other places to go. In other words, ordnance development is finished: what we have today is all there will be! A cold-worked brass rosette to each member of the majority for their naïvete! Where have these gentlemen been during the past ten years and where are they today in their knowledge of ordnance development? Do they know nothing of all the tremendous strides being made in gun construction, gun transport, explosive development, rifle progress, tank development, antiaircraft advances and all the rest—in industry and in Government-owned plants? Again it would take all the pages of this issue of our Journal to describe this progress in barest outline. The details would fill volumes. So ordnance inventive genius is dead—what a bed-time story! We are reminded of that famous incident in the history of the United States Patent Office when just a century ago it was urged that the Office be discontinued because all inventive genius then had gone as far as it could possibly go! We have read that the Commissioner of Patents at that time presented his resignation to the President because he felt there was nothing further to invent and he was only wasting his talents holding down such a job! Anyone who ventures to prophesy that invention here or elsewhere has reached its zenith and in particular that the implements of national defense are even "somewhat more standard" articles, is a prophet who deserves to be without

honor. To anyone so intrepid, the following instance may be a warning. The late renowned G. K. Chesterton called attention to the fact that the hansome cab in 1902 was said to be the very highest and last development of traveling conveyance, yet within a short time thereafter one of these cabs was placed in a London museum as a curiosity!

Of course the aircraft industry should be exempt from any proposal for Government ownership of national defense facilities and so should everything else an army and a navy uses to execute their defense missions. Which is only to say that as these organizations use practically everything the citizen uses and more, everything should be exempt from exclusive government ownership.

THE minority of the Committee has answered the majority and has done a good job of it. However the minority glosses over the question of costs—a subject worth mentioning because John Taxpayer must pay the bill either in money or in human life. He ought to know something about costs in detail. What will nationalization cost in money? The majority of the committee says the cost for shipbuilding will be $23,604,860; for arms producing, as indicated in another report, some $27,300,000. The figures were arrived at by an appraisal of the private shipyards and the few private arms plants. Less than $51,000,000 in all, for our present Army and Navy in peace time. The majority errs. The arms plants that should have been appraised are the 10,000 engaged in ordnance production during the World War, because those, or their present-day counterparts, are really what matter. The shipyards to be concerned about are not the few we have today but the hundreds that had to be constructed by the Emergency Fleet Corporation in 1918 and which might have to be built in another war. They were what our armed forces required in a major war. Who shall say that a future war will require less? And if anyone is so omniscient, let him say how much less. No one with circumspection has ever adopted the method of the Senate Committee by saying that our few private plants—mostly small-arms manufacturing plants—are adequate for the Army of the United States.

Here we should mention the greatest fallacy of the nationalization proposal. Like most fallacies it is simple, requiring no complex figures, no high-sounding phrases and no billingsgate. The fallacious proposal is "Government ownership of facilities adequate for the construction of all warships by the United States Navy Department, also all gun forgings, projectiles and armor plate and of facilities adequate for the production of powder, rifles, pistols and machine guns necessary for the United States War Department." This the committee recommends to meet peace-time needs. For war-time needs it proposes "the mobilization of the war-time production of some or all of the necessary munitions (*sic*) can be carried out in the same way it is now proposed to do." Jigs, tools, and dies necessary for installation in private plants in time of war would be authorized. The fallacy: a supply of jigs, tools, and fixtures available for private plants will insure an ordnance production program in war. Reasons why the fallacy is fallacious: 1. Jigs, tools, and fixtures—as important as they are—are not half the story; 2. The "know how" is at least seventy-five per cent of the successful solution of the problem; 3. Machinery stored away in a warehouse cannot operate itself at the sound of a gong; 4. Types of weapons and the machines for their production are constantly changing (witness World War types of both versus those of today); 5. By excluding private production for peace-time needs and demanding private production for war-time needs—*time*, months and months of it, most vital when war comes, is lost. War, by its very nature, will never be standardized. It may follow definite rules or it may not. One rule it can never follow in the supply of weapons is such nonsense as the above proposal.

Let us take an example to indicate the nonsense. Imagine a long-distance telephone call a year, or ten years or twenty years after nationalization goes into effect (depending on when the people of the United States next go to war)—"Is this Mr. Brown of the Brown, Black, and Green Steel Corporation? Mr. Brown this is the Chief of Ordnance of the Army. We need 10,000 bombs Mark 306, Model 1946A1. Our commanding general at the front is calling for them right off. We want your company to begin to make them immediately. We have surveyed your plant and know what facilities you have. We have the jigs, dies, and fixtures. When can you begin delivery?" A far-away voice: "When can we begin delivery? What a question, General! Do you realize that we have been forbidden by law to make these things for the Army in peace time and now, in war, we are supposed to be able to begin at once? We have never made such a thing in our lives. But we will do the best we can. It may be three months—more probably six!" Meantime our Army is in the field but it does not have those bombs so it has to stand up against all the devices of an enemy and pay the price in blood.

Indeed, we need not project ourselves to the indefinite date of another war or imagine a mythical conversation. We have a factual case today. According to latest public advices, forty-nine of the seventy-nine naval vessels now under construction are behind schedule. Authentic reports give as contributing factors in the delay "NRA requirements, shipyard troubles and *shortage of experienced construction specialists in naval construction.*" We will need the machine tools in war, but we will need experienced construction specialists in ordnance construction. Without trained personnel in private plants, ordnance cannot be made in quantity and quality in time to prevent the loss of *time* in war. The proponents of nationalization have heard of "educational orders" for munitions but they do not like the term. By Government ownership they would destroy the last vestige of anything like educational orders we have ever had! These are some of the costs.

WE will conclude with a restatement of the munitions problem in the United States and the one sane way to solve it. Two years of ballyhoo have served only to make the simplicities complex, to lead unsuspecting people off on tangents and, of course, to make newspaper headlines, build political reputations and poison the public mind. This sort of tactics will not solve the problem. The correct solution was arrived at in 1920 when the nation approved and adopted a National Defense Act which embodies all the experience, sound theory, and wise practice of actual war-time needs. Those portions of the Defense Act which provide for industrial preparedness are as important national legislation as this or any other country ever adopted. They must remain so. They look to private industry to produce the things the soldier needs and do it in a minimum of time with the least loss of life and without excessive profit. In line with these provisions of the Act, the Office of the Assistant Secretary of War for the past fifteen years has devised methods of procedure, plans,

and practices which aim to accomplish this end—not as a military dictatorship but under civilian leadership and control. Never for a moment has Government ownership of all production facilities of armament been contemplated. The reason is not far to seek. The National Defense Act is a guarantee of our military and naval security. Nationalization is a guarantee of our military and naval insecurity.

Further, we have heard a great deal about the profits of munitions manufacturers in war and in peace. There has been much distortion and half-truth and downright misrepresentation in what we have been told. There were excessive profits in war in *every* commodity. No one ever thinks of complaining about the profit in wheat-growing in the United States during the World War but the fact is the price of wheat increased 149 per cent from July, 1914, to July, 1918. For the same period flour increased 158 per cent. Let us take the profit out of war but let us take it out of war-time oats as well as war-time ordnance. And if we are out to remove profits in peace let us take them out of everything or nothing. Let us take them out of legislative salaries and toothpaste and rent and patent medicines; let us not be so foolish as to say that we will take them out of ordnance and let everything else go scot-free. Ordnance has had yardsticks of manufacturing costs generations before today's yardsticks were thought about. Government arsenals have served as a check on manufacturing prices for many years and they continue so to serve today. Indeed there is a better check on ordnance production costs in private establishments than there is on any other manufactured articles in the United States. Excessive ordnance profit *is* removed in time of peace and our industrial mobilization plans will prevent any excessive profit in time of war.

THERE is left only to consider the bugbear that anyone who manufactures arms is by that fact engaged in unethical practices. The charge is absurd. As we have said many times before, there may be individuals here or abroad who engage in unethical practices in the manufacture and sale of arms. The same statement applies to politics, to law, to medicine, to every department of human endeavor. But the exception is not the guide. Just as well condemn the entire legal profession because there are ambulance chasers. It is perfectly silly to condemn a group because of the actions of one or a few. But even in this respect we have adopted in this country legislation for the control of international shipment of arms and implements of war. Its administration is vested in the Department of State where it should be. If this control is sensibly administered it will tend to prevent any undercover transactions in the supply of equipment to unauthorized purchasers.

And so we have industrial preparedness and munitions control by the law of the land. If popular demand, fanned by grotesque charges, creates Government ownership of facilities for the production of arms and nationalization in time of peace, it will have undone all that has been accomplished for our national defense since the beginning of our nationhood. Nationalization in fact means that industry cannot produce the tools of defense in time of peace but that it must produce them in time of war. In other words, industry will be estopped by law from doing in peace what it will be required to do in emergency. During the World War anywhere from six to eighteen months were required by private industry to meet production schedules for ordnance. Nationalization will increase the period possibly to twice the World War figure. Which is to say that the United States of America with its tremendous industrial power, its manhood, and its wealth, will be a giant tied to the ground during the first two years of war. And war in the twentieth century is won or lost at the start. Our only guarantee of security when good-will, conciliation, and diplomacy have failed is a national defense ready and able to enforce our national policy. That guarantee is assured by trained individual man power and trained *private* munitions power. Anything less would be a colossal and possibly an irredeemable blunder.

TO keep the record straight we close this series of editorials with a reminder or two—not for members of the Army Ordnance Association who know the facts, but for others who may chance to read these lines. Once before this Journal published a series of editorials entitled "Facts About Munitions Makers". They were widely read because they were factual. It has been said these editorials attracted the attention of Mr. Stephen Raushenbush, chief investigator for the Nye Committee and thereupon the Army Ordnance Association was "investigated" by the Committee. Be that as it may, we repeat for the record, a quotation from the first of that earlier series of writings (quoting from the May-June, 1934—page 364—issue): "Now the country is to have an official investigation of our 'munitions makers' . . . If the Committee will approach the subject with an open mind and without the obvious antagonism which has characterized the talk of some of its members, then this investigation can be a very helpful and very constructive undertaking. We feel confident that everyone coming within the scope of the Committee's authority who may be called upon to assist it in determining all the facts will do so most willingly." Two months later, in the July-August, 1934, (page 44) issue, we wrote: "Let us again express the hope that the Committee of the United States Senate under the chairmanship of Senator Nye appointed to investigate the munitions industry in the United States will, by its fairness and impartiality, bring to the attention of the people of our country the complete factual story of American munitions today. There never was a time when fairness and common sense based on fact were so greatly needed." Our hope was in vain. The complete factual story of America's munitions, fair and impartial, has not been written; instead a lot of humbug has been foisted on the American people. Manufacturers, financiers, shipbuilders, the Army and the Navy, were held up to ridicule so that today the national defense of the United States is weakened rather than strengthened. The main result of it all (at a cost more than $190,000 to the taxpayers of the United States!) is a grandiose proposal that the Government manufacture its own armament. Which is a perfect example of the old Latin phrase *Pariunt montes, nascitur ridiculus mus*—the senatorial mountains were in labor—and gave birth to a ridiculous mouse. At last accounts the smiling chairman of the Committee was speaking in California on the program of the American League Against War and Fascism; his subject "Who in America wants war?" Some peaceful day, let us fervently hope, the real problem of America's munitions will be brought to the attention of the American people in all its vital meaning. Certain it is that when that day comes the job will not be done—cannot be done—on a box-office basis. It will not be done by "oratorical thunderbolts." Nor will it be done by the nationalization of munitions manufacture. (*The end.*)

Association Affairs

ELECTION OF OFFICERS AND DIRECTORS

IN accordance with the Constitution and By-Laws, the biennial election of Officers and Directors of the Army Ordnance Association will be held Tuesday, September 1, 1936. Polls will close at 12 o'clock noon. The election will be by letter ballot which was mailed on July 31st to all members entitled to vote.

A Nominating Committee appointed by the President pursuant to Section 20 of the By-Laws consisted of Samuel McRoberts, New York, N. Y., Chairman; E. A. Russell, Chicago, Ill.; Roland L. Oliver, Oakland, Calif.; Jere. Campbell, Salem, Mass., and William Carter Bliss, St. Louis, Mo.

The nominees selected by the Committee for terms of office beginning January 1, 1937, are: For President (to serve 2 years): Benedict Crowell, Cleveland, Ohio; for two Vice-Presidents (to serve 2 years): William W. Coleman, Milwaukee, Wis.; and Frederick H. Payne, Greenfield, Mass.; for three Directors (to serve 4 years): Robert P. Lamont, New York, N. Y.; Frank A. Scott, Cleveland, Ohio, and C. L. Harrison, Cincinnati, Ohio.

PHILADELPHIA POST

BRIG. GEN. H. W. SCHULL, Chief of Manufacture of the Ordnance Department, was the principal speaker at the annual meeting of the Philadelphia Post, A. O. A., on the evening of June 19, 1936. Mr. Philip H. Gadsden, President of the post, presided at the meeting which followed dinner served in the North Garden, Bellevue Stratford Hotel. Several hundred members and guests were present.

General Schull spoke on "The Ordnance Responsibility." In his address he stressed the importance of adequate weapon power for the nation's man power. After outlining the elements of weapon production General Schull, referring to industrial preparedness, said: "It is a source of gratification to observe the progress which has been made in our planning with industry during the twelve or thirteen years since our District Office system was adopted. We may truthfully say that our plans in their present state of development insure a high degree of industrial preparedness. We know the probable requirements and have a reasonably accurate knowledge of the capacity of our industries to meet these requirements. We have developed many concrete plans for the construction or conversion of facilities, where necessary to meet war needs, and we are progressing as rapidly as we can with the preparation of specifications and specific procurement plans for many items.

"Industrial preparedness connotes not only the preparation of plans for the procurement of finished articles, but it embraces also the preparation of plans that will insure to essential manufacturing facilities an adequate supply of raw materials, labor, money, power, machinery, and transportation. In addition, industrial preparedness must insure an equitable distribution of war's burden and hardships, and must plan, by the adoption of contract forms which are equitable to both the government and the contractor, to 'take the profit out of war'".

Mr. Gadsden urged renewed interest in the objectives of the Association. He spoke of the realism of our preparedness planning and called attention to the work of the Philadelphia Ordnance District, of which he is also chief. The Executive Secretary of the Association, Maj. L. A. Codd, also addressed the meeting.

The function was arranged by Maj. W. C. Hamilton, Secretary of the Post, who followed the excellent traditions of the Philadelphia organization for genuineness of hospitality and value of the topics discussed. He was assisted by a capable committee of members whose interest has always contributed to the progress of ordnance in the Philadelphia area.

LIEUT. COL. DWIGHT K. SHURTLEFF

THE Army lost one of its most brilliant officers in the tragic death of Lieut. Col. Dwight K. Shurtleff, Ordnance Department, on July 12, 1936. Colonel Shurtleff died when his neck was broken by a strong surf while swimming at Gorgona Beach, sixty miles from Balboa, Canal Zone. He was the Ordnance officer on the staff of the Commanding General, Panama Canal Department.

LIEUT. COL. DWIGHT K. SHURTLEFF

Colonel Shurtleff was born in West Ashford, Connecticut, October 22, 1885. His permanent home was at Willimantic, Connecticut. He entered the United States Military Academy, from Connecticut, on June 15, 1906, and was graduated and commissioned 2nd lieutenant of Cavalry, June 15, 1910. He began his service in the Ordnance Department in 1912.

During his service in the Army he was stationed at various posts throughout the United States; in the Philippines and in Mexico. He was on duty in the Office of the Chief of Ordnance from May, 1917, to July, 1921; at Fort Leavenworth, Kansas, student officer, Command and General Staff School, from July, 1921, to August, 1923, when he was graduated; a student officer at the Army War College from August, 1923, to July, 1924, when he was graduated; in the Office of the Chief of Ordnance, July, 1924, to July, 1928; student officer, Army Industrial College, July, 1928, to July, 1929, when he was graduated; at Aberdeen Proving Ground, Maryland, as duty officer from July, 1929, to July, 1931; at the Command and General Staff School, as an instructor, from August, 1931, to July, 1935. He had been on duty at Corozal, Canal Zone, since July 15, 1935.

Colonel Shurtleff received the Victory Medal; Mexican Service, and the following foreign decorations: Order of Leopold, II; Order of Polonia Restituta.

"Deak", as he was familiarly known to his friends, will be missed. He was a capable, energetic officer, a gentleman of highest character. His untimely death deprives the Army and the Army Ordnance Association of a valiant member.

MAJ. JOHN M. ERWIN

AS this issue of ARMY ORDNANCE closes for press, word comes of the death, on August 4, 1936, in Washington, D. C., of Maj. John M. Erwin, Ordnance Department, for the past several years personnel officer in the Office of the Chief of Ordnance. His death, following an illness of one week, removes with tragic suddenness a remarkable young officer who had proved his talents for valor and achievement as an Infantryman in war and an Ordnance engineer and administrator in peace. For several years he had contributed regularly to these pages as author and book reviewer. In this issue are several of his reviews, signed with the familiar "J.M.E." Later, a more adequate tribute will be published to honor the memory of Jack Erwin whose loss is too poignant for expression at this writing.

Ordnance Field Service

AMMUNITION SUPPLY, PART III

By LIEUT. COL. RAYMOND MARSH, *Ord. Dept., U. S. Army**

SOMEWHERE in the channel of supply between initial procurement and ultimate consumption, supplies and the responsibility therefor must be turned over to the using troops. The logical place for this transfer appears to be that place where transportation of the troop units receives such supplies. Except for initial issues and reëquipment this place generally is a distributing point. This transfer now occurs at the distributing points for the supplies of all the supply arms and services except the Ordnance Department. Except for the Ordnance Department, these supply arms and services are provided with the adequate personnel, organization, and transportation needed to permit the full discharge of this function. The transfer of the actual physical possessions and responsibility therefor, of all Ordnance items except ammunition, likewise takes place generally at these distributing points. It appears to be logical to make this system and method of the transfer of the physical possession and responsibility for property of all types, including ammunition, at the distributing points, and not at several places along the line of supply. To effect this transfer at distributing points would put into actual operation that fundamental principle of supply that the impetus of supply shall be from rear to front.

I have pointed out that the employment of a day of fire as a measure of loading of a service train is unsatisfactory because of its changing characteristics. As a measure of supply, its continued use arouses no objection. But for a unit of loading, some more definite measure must be employed and the loads of the several echelons of supply must be related to each other on the basis of some reasonable and logical principle. The capacity of troops to transport ammunition is limited by the prescribed loads of the individual, or the team of a group weapon or of the combat train pertaining to the troops. This capacity is very definite and fixed, depending as it does, upon the authorized equipment specified in tables of organization, etc. When troops are resupplied with ammunition through the medium of the combat trains, the complete reloading or refilling of the combat trains is the most efficient combination of transportation and ammunition supply that can be devised. Any unfilled capacity of the combat trains fails to utilize the available transportation. Any surplus ammunition over and above the capacity of the combat trains puts the ammunition in an unsatisfactory status of storage, or else employs other vehicles to continue the ammunition in a status of what we are pleased to call "rolling reserves", but which in reality is a status of portable storage. To utilize to the utmost advantage the available transportation and existing supplies, a principle has been developed in the Ordnance Department which has become known as the "refill principle". This refill principle is not a unit of measure but it is a principle. And it is that principle which, if applied, would set up the proper relationships between the ammunition loads which should be carried in the combat trains and the ammunition trains of the higher echelons of supply. Briefly stated, the refill principle is this—the quantities of ammunition transported in the several supply echelons should be so regulated and so related to each other that each echelon may completely fill the appropriate vehicles of the echelon next below it, and in turn be completely filled by the vehicles of the echelon next above it. In the application of this principle, due allowances must be made in the quantities of ammunition carried in each higher echelon, for the additional types and varieties of ammunition which must be transported to each echelon as we move from front to rear.

I DO not propose at this time to discuss the details of the recommended organization for ammunition supply. It will suffice to touch upon the organization only in general. In the division, it is recommended that the ammunition supply service should consist of an ammunition train which would not only include sufficient transportation and operating personnel to carry the desired ammunition, but also sufficient additional personnel to handle this ammunition in loading and unloading, and to provide the necessary operating personnel at distributing points. Such an organization would replace the elements of the Quartermaster regiment of the Infantry division, now employed in hauling small arms ammunition. It would replace the elements of the service company of the Quartermaster regiment of the Infantry division, now engaged in handling ammunition at distributing points, division dumps, etc. It would replace the ammunition train of the field artillery brigade of the Infantry division, and it would replace the elements of the corps Quartermaster train, now carrying ammunition for the several Infantry divisions of the corps. Similar appropriate ammunition trains for corps and armies have been included in these recommendations. Studies prepared in the Office of the Chief of Ordnance indicate that such an organization will effect material savings in personnel, animals and vehicles, provided that from existing service organizations there be eliminated those elements whose present functions would be performed by the newly created ammunition trains. Such an organization would also insure greater flexibility of ammunition supply, would provide a larger common pool of ammunition transportation, and would give the highly desired unity of control, undivided authority and responsibility, and centralized command. It would eliminate the present miscellaneous ammunition-carrying units by their consolidation into one organization. By providing a pool of ammunition-carrying transportation, it will make it unnecessary to attach, detach, or otherwise reorganize units in order to obtain the desired flexibility in the supply of the several types and varieties of ammunition. If the loads in this ammunition train are prescribed in accordance with the recommended refill principle, it will provide the division commander at all times with, and place under his undivided control, one complete reloading or refill for all combat trains in his division. Summing it up, it consolidates all ammunition service elements for the division into a single unit within the division, organically a part of it and under the undivided command of the division commander, exercised through a single staff officer and controlled through the normal channels for Class IV supplies. These recommendations are receiving the serious consideration of the War Department and all arms and services concerned. It is earnestly to be hoped that they will ultimately be adopted.

From an organizational viewpoint, little can be gained from a comparison with the French and British systems of ammunition supply, because the basic organization of these two armies differs so materially from ours. From a functional point of view, however, much can be gained by noting how these two armies operate their ammunition supply services. Although the organizations differ, each possesses a unified ammunition supply service, controlled by a staff officer under the commanding general of the major tactical organization involved. There is a distinct ammunition supply organization. Centralized control, undivided responsibility and unity of command are provided. Responsibility is combined with authority. The organization is not molded with pooling of vehicles as one of the prime con-

*This discussion presents the personal views of the author and does not represent any official policy on the subject.

siderations. Compliance with the fundamental principle of supply that the impetus shall be from rear to front is maintained.

In the French Army, their *Service d'Artillerie* combines what we know as mobile artillery with the field service of the Ordnance Department. The French Ordnance Department is but little more than a technical laboratory devoted to research, design and development. In the organization of this artillery service, artillery parks are provided for the corps and army. These artillery parks include the organization, personnel, and equipment for the supply of all kinds of ammunition, and the replenishment and/or repair of unserviceable matériel. The personnel is trained; no diversion of matériel under the guise of pooling is normally contemplated; and the park is under the command of the commanding general, not some subordinate occupying a privileged position, nor some senior who does not share the responsibility. These artillery parks resemble what it is now proposed shall be organized in our own service under the designation of Ordnance battalions or regiments, to perform these services of ammunition supply and replenishment and maintenance of matériel.

In the British Army the great transportation and supply service with the field forces is the Royal Army Service Corps (R.A.S.C.). The Quartermaster General's Department and the Department of the Master General of Ordnance in the British army, are essentially research, design, development and procurement agencies. The R.A.S.C. is organized in groups for assignment to divisions and corps. An R.A.S.C. group for assignment to a division consists of an administrative headquarters and four companies, one each for ammunition, baggage, supplies, and repair facilities. This divisional R.A.S.C. is an integral part of the division and is under the direct control of the general commanding. As in the French Army, here is a distinct organization created for the chief purpose of transporting and handling ammunition. Its personnel are trained and its equipment is devoted to ammunition hauling and not general cargo purposes. The British Field Service Regulations contain the provision that "in mobile operation, no lorries or other vehicles provided for the transportation of ammunition should be diverted from their legitimate functions except in very exceptional circumstances." And further, that "troops in action should never have to turn their backs on the enemy to fetch further supplies".

The A.E.F. Superior Board on Organization and Tactics stated: "It has been proposed that the ammunition service be turned over to the Ordnance Department to be under their charge up to the 'using' services. The experience of our forces in this war does not lead the Board to recommend this departure from the methods employed. While these methods were not always without possibility of improvement, they succeeded". These methods worked, not because of the soundness of the principles on which they were based nor because of the correctness of the organization provided, but because of the expedients and improvised measures adopted. Although differing radically in organization, the French and the British ammunition supply services are based on the same principles, on principles which their experience has proved sound. Although our organization was originally based on the French, fundamental differences in basic army organization renders parallel unit organization unsound, if not indeed impossible. Moreover, radical departures have been made from our original organization until now only the form resembles the French model which it tried to duplicate. Soundness of principle rather than similarity of organization should govern. The French and British have found justification for basing their ammunition supply services on centralized control, undivided authority, unity of command, a combination of responsibility with authority, and the assurance that the impetus of supply shall be from rear to front. Our ammunition supply service should be so reorganized as to incorporate these principles in its organization and operation. (*In the next issue the author will begin a discussion of Army Ordnance Service.*)

Professional Notes

The Bren Light Machine Gun

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AT the beginning of the Great War the only machine gun in general use was a weapon weighing, with its mounting, somewhere about one hundred pounds or more and capable of prolonged fire at a high rate. Such weapons were the British Maxim and Vickers, the French Hotchkiss and the German Maxim. They were intended to be used in more or less fixed positions in support of the rifles which, in our Army at any rate, formed the main source of infantry fire power at that time. Under the trench-warfare conditions, which so soon set in, the weight and bulk of these heavy machine guns were not serious objections, and their capacity for sustained fire was an advantage. They dominated the battlefield and it was obvious that they must become the mainstay of the defense. To meet the demand for more machine guns, the Lewis was brought in to supplement the Vickers, which could not be produced in sufficient quantities.

The Lewis was altogether different in character from the Vickers. It was air-cooled and was fired from the shoulder on a low bipod rest. It was also magazine-fed, and weighed, complete, about thirty pounds. It was therefore essentially a more mobile weapon than the Vickers, although it had not its capacity for sustained fire. It was a weapon capable of being employed alongside the rifles or as a substitute for them under open-warfare conditions, i.e., it could be taken forward in the attacks, and a Lewis gunner could go practically anywhere that a rifleman could go. It was, however, still not possible to carry it by hand for long distances without fatigue.

The German version of this weapon was the so-called light Maxim. The French produced a gun called the Chauchat. All the above were light machine guns with characteristics different from those of the heavy machine guns in use hitherto. Their advent in theory released the heavy machine gun for use in the rôle for which its characteristics made it suitable. In practice, however, the reliability of the light machine gun was not sufficient to justify this.

It was obvious that if the light machine gun could be still further lightened and its mechanical reliability improved, the fire power of the infantry, under all conditions, would be enormously increased. A single light machine gun served by two men is the equivalent in fire power to twenty men armed with rifles; the limiting factor in multiplying the number being ammunition supply only. On the assumption that the target for these guns would continue to be the unarmored man, the logical conclusion was to increase the number of guns to saturation point. Experience showed that a section of about six men can supply and keep in action for the requisite period of time one light machine gun. The main duty of four of these six men is carriage of ammunition. Fewer men per gun or, alternatively, more guns per section means either loss of mobility by reason of the greater ammunition load per man, or loss of capacity to sustain fire in sufficient volume. Saturation point is therefore approximately one light machine gun per six men. The latest experimental organizations have reached or are approaching this proportion. War experience having led to this conclusion, peace brought

with it a period of renewed activity throughout the world in the field of light machine-gun design.

Vastly improved and lighter machine guns were produced and tried out all over the world. All had similar characteristics: a weight complete of about twenty pounds, feed from a magazine holding twenty to thirty rounds, air cooling, generally some form of quick-change barrel and much simpler mechanism. Most of them were operated from gases taken from the barrel. An attempt was made by the old-established firm of Madsen to combine in one weapon the functions of both the light and heavy machine guns. They proposed to achieve sustained fire by the process of ringing the changes on a series of quick-change air-cooled barrels. The light gun, when used in the heavy rôle, was mounted on a tripod weighing very little more than the gun itself. Stability was insured by the use of spring buffering, and the form of the tripod with two widely spread legs at the rear. This attempt led to a great advance in the design of equipment of this kind, but has not enabled the light machine gun to compete with the heavy gun in its own field. Belt-feed, water-cooling, and heavy barrels have advantages where sustained fire at high rates is required, and these features are incompatible with a really light and mobile weapon. It is therefore likely that the two types of gun will remain in use. For certain purposes, notably use by cavalry, however, a light machine gun mounted on its light tripod can give sufficient sustained fire.

British trials of light machine guns to replace the Lewis, began in 1922, but did not result in the adoption of any new weapon, although a modification of the light Browning was recommended, should the need arise. A new series of trials was started in 1930 in view of the very rapid strides made in design, and one of the guns selected for trials was the Z.B., made at Brno in Czechoslovakia. This gun had already gained a very high reputation among those who had tried it, and very little experience showed that this reputation was well founded. It had qualities which made it altogether outstanding. The change-over from the nitrocellulose propellant, for which the gun had been developed, to cordite, brought with it certain troubles due to the heavy metallic fouling caused by this powder. This entailed certain modifications to the design. The British rimmed cartridge also caused a certain difficulty in the feed to and from the magazine. The gun modified to meet British requirements was called the Z.G.B. The trials were concluded in 1934, and in 1935 the gun was finally approved for adoption under the name Bren, a word formed from the initial letters of its birthplace, Brno and of the British factory at Enfield, where it will be made.

The chief qualities of the Bren light machine gun are low weight, i.e., twenty-one pounds complete, as compared with thirty-one pounds for the Lewis, extreme steadiness when firing, almost complete immunity from the effects of fouling, dirt, and dust, great freedom from breakage and stoppages, and the ability to maintain a high rate of fire for relatively long periods.

Its main features, which render the gun unique, are the system of buffering the moving and recoiling parts, and the arrangements for the collection and disposal of metallic fouling in the gas system.

The extra two-piece leg required for antiaircraft fire is normally carried in the main tubes of the tripod. A rifle can be used as a substitute if necessary, being fixed by the bayonet stud. The complete tripod weighs approximately twenty-five pounds and provides a wholly stable platform for indirect or overhead fire, or fire on fixed lines.

Infantry Fire Power and Mobility

ACCORDING to the *Army and Navy Journal* the new Infantry organization, designed to increase the flexibility, mobility and fire power of the Infantry regiment, will soon be announced. The project has been under test by the 29th Infantry at Fort Benning, Ga., since last October. While the final report has not yet been submitted and the ultimate form of the new organization is not yet authorized, there are indications that the new organization will be a major departure from the old. According to the *Journal*, the new Infantry regiment as recommended will have four combat battalions, three rifle and one special weapon. Other characteristics of the unit are:

It has no animals or animal-drawn vehicles; the only non-motorized elements are rifle companies except for their trains and the foot sections of regimental headquarters and the three battalion detachments of the rifle battalions. All riflemen are equipped with the semiautomatic (selfloading) rifle, capable of approximately twice the rate of aimed fire of the Springfield. In each rifle section there are two rifle squads and one light machine-gun squad—all squads consisting of a corporal and six men. It has an antitank company (cal. .50 machine gun) which has a secondary antiaircraft mission. The howitzer company is equipped with six mortars (81-mm.) instead of three mortars and three 37-mm. as at present. Battalions have headquarter detachments, instead of companies, contain no intelligence platoon but have, instead, a group of one corporal and three privates as observers.

Communications platoon contains no wire, radio or panel sections. The regiment has about 500 less men, but about the same number of officers as the old regiment. Service company is commanded by a major. Contains fewer noncommissioned officers as a whole, but has thirty-eight more sergeants. Water and gasoline are carried in containers in a truck; no tank trucks are used for those purposes. Its fire power is slightly greater for defense, but considerably greater for offense, due chiefly to the semi-automatic rifle.

Ordnance Patents

RECENT patents for ordnance and related equipment include the following:

A mount for antiaircraft guns so arranged and constructed that the outriggers when folded form the frame of a vehicle; to Thomas A. Conlon and George W. Beatty (No. 2,043,989).

A firing mechanism which may be mounted in the breech ring and in which the hammer may be locked in various positions of adjustment; to George M. McCann and Charles T. Kohler (No. 2,044,008).

A cartridge for projectiles containing strip propellent powder from which portions of the strip may be withdrawn and detached for zone firing; to Lieut. Robert D. McLeod, Jr. (No. 2,043,256).

A fuze for projectiles in which the interrupting elements are carried by the plunger and hold the plunger against movement. When the interrupting elements are moved by centrifugal force to armed position they are held in such position by positive means; to Gilbert E. Rogers (No. 2,043,266).

A pressure indicator designed primarily for registering the air pressure in a pneumatic tire so as to warn when the pressure is too high or too low; to Lieut. Col. John H. Woodberry (No. 2,043,277).

Correction

IN the May-June issue of ARMY ORDNANCE, on page 382, an incorrect reference was made to the principal plants for the manufacture of titanium pigments in the United States. Correct information on this subject is as follows: the three manufacturers of titanium pigment are Titanium Pigment Co., Inc., operating plants at St. Louis, Mo. and Sayreville, N. J.; the Krebs Pigment & Color Corporation, operating plants at Baltimore, Md. and Wilmington, Del.; and the American Zirconium Corporation operating a plant at Baltimore. The original plant for the manufacture of titanium pigments, built by the Titanium Pigment Company, Inc. at Niagara Falls, N. Y., in 1917, was permanently discontinued as an operating unit in March, 1936.

Chronicle

THE Securities and Exchange Commission has ruled that details of contracts with the Federal Government relative to the national defense need not be included in a registration statement filed under the Securities Act of 1933 if disclosing such details would be contrary to the public interest. The contracts exempted are those of which a copy is on file with the executive department which has notified the registrant that it would be against public interest to disclose the details. Such contracts include those covering construction or supply of materials, experimental facilities, or information to the defense services.

Gen. Malin Craig, Chief of Staff, addressing the ninety-six officers of the Army, Navy and Marine Corps who composed the largest class ever graduated from the Army War College said in part: "It is highly important to have a thorough knowledge of the so-called principles of warfare, to know the orthodox tactics to follow to attain results. It is likewise important to consider the effect of a surprising and audacious move by doing the unusual, the unexpected. It is more important to win a battle than to be consistent. It is better to be an unorthodox victor than to be regular and defeated. A cautious commander may save his army; the bold leader is likely to save his country. The country's fate is more important than the general's reputation."

A recent act of Congress has made it permissable for officers and men to wear decorations awarded by foreign governments.

MAJ. GEN. FRANK. R. McCOY, commander of the Second Corps Area, and Maj. Gen. Frank M. Andrews, Chief of the GHQ Air Force, in a flight from San Juan, Puerto Rico, to Langley Field, Va., established a new nonstop distance record for amphibian planes, June 29, 1936. Flying in the Air Corps Douglas OA-5 they covered the 1425 miles in eleven hours and nine minutes. Also on the flight were Maj. John F. Whiteley, copilot with General Andrews; Lieut. Hugh F. McCaffery and Lieut. Joseph A. Miller, navigators; Corp. John McKenna, crew chief; Priv. Ralph A. Minor, assistant crew chief, and Priv. Charles J. Archer, radio operator.

Under Australia's new hundred-million-dollar defense program, a fleet of thirty-three Avro Anson planes, costing five million dollars will be brought from Great Britain, while a $750,000 air force station is to be established at Richmond, near Melbourne. A 4000-mile coast-defense plan has already been inaugurated. Sydney, chief naval base, is said to be equipped with the largest regular military weapon in the world—the first unit of new defense ordnance. The new naval program calls for a fleet of four cruisers, one surveying ship, one flotilla leader, eight destroyers, two sloops and one seaplane carrier, while the peace-time army is to stand at 35,000. From the industrial aspect, plans have been considered to establish a complete aircraft industry in Australia irrespective of bounties or subsidies. A. S. Ford, manager of the Lithgow Small Arms Factory, has been investigating the new Bren light machine gun adopted by the British Army (see Professional Notes).

A sergeants' small-bore rifle squad of the 15th Infantry, Tientsin, China, defeated a team of English sergeants by a score of 1113 to 1048.

The American patent system reached the age of one hundred years on July 4, 1936. A century previous to that date, all existing patent laws were revoked and a new system instituted

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which required the submission of models and a strict examination of the claims of the inventor to determine their originality and practicability.

A NEW exhaust-driven supercharger for stratosphere flying has been announced at the Matériel Division of the Air Corps at Wright Field. It is claimed that the new device, which operates at a speed of 40,000 revolutions per minute, will enable Army planes to outperform any others in the world at high altitudes.

The Distinguished Flying Cross was conferred posthumously by the Army upon the late Maj. Hez McClellan for extraordinary achievement as commander and pilot of the Army's cross-country flight from Washington to Nome, Point Barrow, and other Alaskan points in 1935. Major McClellan was killed testing a pursuit ship at Dayton, Ohio.

President Roosevelt, by declaring that a state of war no longer existed "in fact" between Italy and Ethiopia, raised the embargo on arms, ammunition and implements of war which had been imposed by his proclamation of October 5, 1935.

Hereafter, under the new Air Corps organizational set-up, in which the station complement at GHQ Air Force stations is placed under the GHQ Air Force Commander, the senior officer at the station will command the station. Heretofore the officer in command of the GHQ Air Force unit was always of higher rank than the station complement commander. Now, the officer in command of the station will rank the officer in command of the unit, and as he is under command of the GHQ Air Force Commander, orders from the latter to the Air Force unit will come through him. While the unit is on the ground it will be under the station commander and he will be the immediate superior of the unit commander. But when the unit leaves the station to operate as part of the Air Force, the chain of command will switch to Air Force organization.

Capt. Albert W. Stevens and Capt. Orvil A. Anderson, Army stratosphere balloonists, have been awarded the Mackay Army Aviation Trophy for their record-breaking ascent of 72,395 feet made on November 11, 1935. The trophy was presented by Maj. Gen. Oscar Westover, Chief of the Air Corps.

FIVE U. S. Navy destroyers will soon be reduced to junk after being sold to the highest bidder through the Navy's Bureau of Supplies and Accounts. They are the CUSHING, NICHOLSON, WINSLOW, WADSWORTH, and CALDWELL. The London Naval Treaty of 1930 stipulates that vessels due for disposal must be scrapped literally—they may not be sold to another nation or kept in private service in a condition that would make it possible to convert them again into fighting craft. Purchasers of such vessels must post $10,000 bonds to insure the fulfillment of this condition.

The Air Defense League, an organization which aims to bring before the public "the true importance of aviation as a weapon of national defense", has started a campaign to increase both its scope and its membership. The list of speakers at a private dinner in New York opening the campaign included John J. McSwain, chairman of the House Military Affairs Committee; Col. A. H. Frank, commanding the Army air station at Mitchel Field, N. Y.; Commander C. E. Rosendahl, commanding the naval air station at Lakehurst, N. J., and Samuel P. Wetherill, president of the Air Defense League. The organization is composed of and financed by a group of young professional and business men who are coöperating with Army and Navy air officers in the interests of national defense.

Maj. Gen. Douglas MacArthur, former U. S. Chief of Staff and now principal military adviser to the Philippine Government, has recommended an economical and comprehensive defense plan for the island commonwealth. An expenditure of $80,000,000 during the first ten years of the plan's operation will provide a fleet of small, fast torpedo boats for coastal defense, a regular army and a reserve corps, and an air corps consisting mainly of fast bombers. The maximum strength of the army under the recommendation will be about 930 officers and 6500 men.

Book Reviews

ADVENTURES OF GENERAL MARBOT. By Maj. J. W. Thomason, Jr. New York: Chas. Scribner's Sons. 1935.

WHETHER one has or has not read the memoirs of the Baron de Marbot, either in their original voluminous edition or some of the edited and abridged forms, one is sure to be fascinated by this interesting and entertaining addition to the literature of the Napoleonic era.

Marbot entered his Emperor's service in 1799, when he was but seventeen. He came from a military family, his father, Gen. Charles de Marbot having served in the household cavalry of Louis XV. Unlike most of the men with whom Napoleon surrounded himself, Marbot was not a commoner but came from the aristocracy. He entered the cavalry, as might be expected from his father's record, was a private of hussars and by 1812, after only thirteen years service, he was a colonel and commanded a regiment of mounted chausseurs in that terrible Russian campaign.

However, a soldier of ability, intelligence and courage rapidly accumulated training, experience and promotion in the armies of Napoleon. Marbot's career reads like a novel. He served in close contact with Napoleon and under marshals of France whose fame will never die—Lannes, Ney, Augereau, and Massena, to mention but a few. His campaigns and battles included Austerlitz, Jena, Eylau, Wagram, Leipzig, the horrible crossing of the Beresina, the Peninsular campaign and the retreat from Moscow.

Marbot's personal experiences rival those of a Munchausen. He was wounded a dozen times; engaged in countless encounters either single-handed or at the head of his command against the soldiers of all nations who dared oppose the great Napoleon; stripped of his clothes and left for dead on a battlefield in mid-winter; crossed the Danube under flood conditions and other circumstances that made the mission so dangerous that even his Emperor advised against it; and captured Ratisbon with but a handful of troops. And so it runs on for some three hundred pages.

Marbot is not a military historian in any sense of the word. True, he describes at considerable length and with pleasing accuracy those campaigns in which he participated, but he writes almost entirely of those incidents and events which involved him personally. So it is a very human story and clothes the reputations of famous names with a cloak of human existence.

Although there are several editions of the memoirs of the Baron de Marbot in existence, this is the first abridgement, to my knowledge, that incorporates in a smooth, connected fashion the most interesting and exciting episodes of the General's thrilling career. Not the least fascinating part of this book are the sketches by the author which, as the *New York Herald Tribune* said "are ready to move on as soon as you take your eyes off".

Major Thomason, the author—or should I say, compiler?—needs no introduction to military readers. His other books, such as "Jeb Stuart", "Fix Bayonets", and "Salt Winds and Gobi Dust", established his reputation. This book enhances it. R. M.

DISEASE AND DESTINY. By Ralph H. Major, M. D. New York: D. Appleton-Century Co. 1936.

HISTORY is usually a more or less prosaic list of names, dates and places, chronicles of wars, tales of political and diplomatic intrigue and accounts of important legislation, social progress and outstanding inventions and other scientific achievements. But

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does that list include all the factors which exert a deciding influence on human progress and national history?

Dr. Ralph Major, the author of this interesting contribution to the history of mankind, develops the thesis that disease has been a prime factor in controlling man's destiny. The bubonic plague, spotted fever, tuberculosis, smallpox, diphtheria, malaria, leprosy, yellow fever, hemophilia and syphilis are specially discussed.

According to Dr. Major, it was the Black Death, or bubonic plague, that caused the death of Pericles, ended the Golden Age of Greece and started the transition of Greece from the foremost power of the day to a poor and feeble state. Malaria was one of the chief causes of the fall of Rome. Hemophilia in the Czar's family opened the door of the Russian court to Rasputin, and who can say how much he contributed to the downfall of the Romanoff dynasty? The same disease cursed the royal family of Spain and changed the succession of that dynasty. Dr. Major's investigation of the source of this disease in these two royal families is exceedingly interesting.

Syphilis is "the worst plague of all", according to this author. Henry VIII was one of its victims, Nietzsche was infected by it and there is reason to believe that Lenin was also. Surely these men, particularly the last two, have wrought tremendous influences in the history of mankind.

The book is well written, bears evidences of an extraordinary amount of research and is filled with interesting episodes, descriptions and stories of those who in some way or another have been victims of disease or victors in the struggle to overcome those diseases. Time spent reading this book is time well spent.

R. M.

WHY WARS ARE DECLARED. By George Willison. New York: Basic Books, Inc. 1936.

THIS little book of but little more than one hundred pages starts off with a score or so of pages devoted to some of the more arresting newspaper headlines of those hectic years 1914-1918. Then follows a discussion to show that war is an unnatural condition and that it all flows out of the institution, centuries ago, of the right of individual ownership. To the author, the World War was fought solely to protect financial interests; we entered the war to underwrite the Morgan loans to Europe and the chief result of American participation was the creation of some 21,000 millionaires in the United States.

Who won the war? the author asks. "The capitalists of every country but Russia where their services were dispensed with." And so we are led to infer that Russia is now a land of milk and honey, peace and prosperity, joy and bliss. The inquisitive soul from Missouri might be prompted to say, "Oh, yeah?".

Instead of learning the answer to the question which is the title of this book, I was led to recall to mind that homely statement of a wise man who said, "It ain't what we don't know that causes the trouble but knowing so much that ain't so!". R. M.

THE CARIBBEAN SINCE 1900. By Chester Lloyd Jones. New York: Prentice-Hall, Inc. 1936. $5.00.

THE foreign policy of the United States is always being criticized severely for one thing or another until there has grown up among her citizens a general feeling that weakness in international dickerings and vacillating management of such matters is inherent in our democracy. As a matter of fact, in affairs of vital interest, the United States has pursued her course with singular directness of purpose and consistent strength. For instance, our frontiers were pushed west to the Pacific Ocean practically in one fell swoop, irrespective of self-determination of subject peoples, integrity of national territories, or any other political catch-phrase. Our right to use the high seas upon all lawful occasions we have maintained manfully with powder and shot. And as an examination of this book will show, our strategic interest in the Caribbean area has grown stronger with the pas-

sage of years since the middle of the nineteenth century, until we have come to exert a true dominance over that nerve center of the Americas.

Professor Jones summarizes the strange histories of the states which fringe that fateful body of water, and dwells on the relations between each one of them and the United States. The impression that remains is that the Colossus of the North has been paternally tolerant, generally efficient, and in refraining from any wide program of annexation, remarkably wise. Our federal union could be set quickly upon the rocks of hopeless chaos should we ever take it into our heads to accumulate on a large scale the odd races of the Western Hemisphere that cluster about the equator. Our record of intervention is long and troublesome, but there again we are "damned if we do and damned if we don't". Hence if condemnation is inevitable, it is better that something be accomplished. And herein the account is clear; the marines have invariably brought with them an intermission in civil strife, sanitation, untangled finances, and an opportunity for journalists to enter the country in safety in order that they may describe the horrors of intervention. In this connection these lines of Kipling's are perhaps too easily recalled:

"Take up the White Man's Burden
And reap his old reward:
The blame of those ye better,
The hate of those ye guard."

But blame and hate matter little when a great nation pursues its national interest, and as every student of history knows, our inflexible purpose is nowhere better displayed than in the maintenance of our trade route from the Pacific to the Atlantic.

The most interesting portion of the book is that which deals with the negotiations for the Panama Canal. It is to the eternal credit of the Administration of the time, that the Canal was built. Thereby, incidentally, was created a theme for professional moralists that has provided jobs for thousands of printers, book binders, etc.

As a single volume on the involved histories of our turbulent neighbors, this book is a convenient reference work, and as such merits the attention of military men. Any one who wishes to study the subject in greater detail will find the included bibliography most valuable. J. M. E.

DEATH IN THE DESERT. By Paul I. Wellman. New York: The Macmillan Co. 1935.

THE reader of international news can do scarcely anything other than form the impression that the United States, in its dealings with nations, is thoroughly and sincerely actuated by the "good neighbor" doctrine, that it is without love of conquest or greed for gain. It is somewhat of a shock, then, for one unacquainted with the story of our Indian relations to turn back the pages of history for only a part of the last century and learn that instead of being a "good neighbor" to the Indian we were greedy, unscrupulous, often treacherous and frequently as cruel as any of the savages. The story of our Indian relations has perhaps rightly been termed "a century of dishonor."

Mr. Wellman, in this book, has portrayed in vivid, forceful narrative, the relentless and remorseless encroachment of the white man upon the desert country of the red man and the desperate struggle of those red men—Apaches, Pueblos, Modocs and other primitive tribes—to hold back that encroachment. The end was the same that history so often records—the inferior civilization yielded to the superior one. The chief regret is not that the Indian civilization succumbed but that the white triumph was so marred by treachery, broken promises, political graft and incompetent administration of subjugated tribes.

It is consoling to find one page in this record that is reasonably clean. And that page is the one on which is recorded the part played by the Army in the pacification of this southwest country. True, instances of stupidity and incompetence can be

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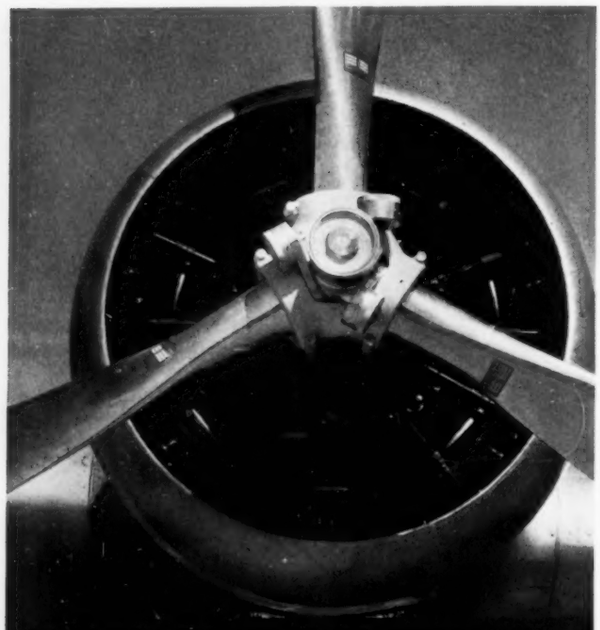

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cited but more frequently it is shown that the Indian looked on the soldier as his friend, that the Army often undertook operations against the Indians under protest and that reports of the scandalous graft and incompetence of so many of the Indian agents originated frequently from Army sources.

In the Southwest the names that fill these pages are still known even though the story ends fifty years ago—Mangus Colorado, Cochise, Victorio, Geronimo, Crook, Brown, Crawford, Gatewood and Miles, and many others both red and white.

Mr. Wellman who is well qualified to write the story of the Indian fights has painted the whole picture in this book and the companion work, "Death on the Prairie" which narrates the wars on the plains. These two books cover a phase of American history which is all too little known generally. The author is to be congratulated on both the subject matter and the presentation.

R. M.

HISTORICAL ARMS AND ARMOR. New York: The Metropolitan Museum of Art. 1935. 25¢.

STEPHEN V. GRANCSAY, Curator of Armor at the Metropolitan Museum of Art, has prepared this beautiful brochure containing 21 halftone plates of classical arms and armor. As the author states, "Each of the objects shown in this picture book is a potential teacher of history". Beginning with the etched and guilded harness which belonged to Galiot de Genouilhac (1465-1546), Grand Master of Artillery of France—and probably not unlike the one he wore at the ceremonies held on the Field of the Cloth of Gold, the illustrations carry the reader through the pomp and glory of a colorful age by presenting the arms and armor of historic personages. The series concludes with the highly embellished partisan of the state guard of Maurice of Nassau, Prince of Orange (1567-1625) and the fauchard of the state guard of Cardinal Camillo Borghese (1600). In its few pages this little brochure contains a wealth of historic objectivity which should appeal to every lover of arms and armor.

L. A. C.

THE TEXAS RANGERS. By Walter Prescott Webb. New York: Houghton Mifflin Co. 1935.

IN 1835, while Texas was in the throes of successful revolution against the rule of Mexico, the general council of the Texas government passed an ordinance authorizing the creation of a corps of rangers primarily to protect the frontier. In 1935, the legislature of the state of Texas passed an act establishing the Department of Public Safety, which set up a Highway Patrol and all but wiped out the Texas Rangers. In all probability, as time marches on, the functions of the un-uniformed Rangers will decrease and those of the Highway Patrol increase. Thus, that famous group of law enforcement officials of the Southwest faces abolition after almost exactly one hundred years of existence.

In that century of operations, probably no organized group of men have gathered unto themselves such a glamorous reputation as have these Texas Rangers. Their duties varied from fighting regular Mexican troops in the Revolution of 1835 to chasing bootleggers in that noble experiment of prohibition in the 1920's, including fighting Indians, repelling smugglers, pursuing horse thieves, exterminating cattle rustlers, and generally making existence for the Southwest bad man a precarious one. It is claimed that in their century of existence they have killed well over five thousand men, although, at any one time, their number seldom exceeded two hundred. To build up this record they had to "ride like a Mexican, trail like an Indian, shoot like a Tennessean, and fight like a devil."

The author is a professor in the University of Texas and is recognized as one of the ablest historians of the Southwest. This book bears evidence of painstaking research to which is added an attractive style of narrative and an evident first-hand acquaintance with life and custom in that empire of the Southwest.

Some of the accounts appear unduly long and filled with too many details, but such accounts are enlivened by the reports of the participants themselves, phrased in the colorful vernacular of the border, and the unconscious humor of the writer. So it is a very readable book and covers a phase of our national existence which is rapidly fading into the past. In making this part of our history a matter of record, Professor Webb has done a good job and has rendered a real service. R. M.

AMERICAN SOLDIERS ALSO FOUGHT. By Gen. R. L. Bullard and Earl Reeves. New York: Longmans, Green and Company. 1936.

THE principal author of this book needs no introduction. His record and reputation is such that no elaboration is needed to show his ability and the first-hand knowledge needed to write this book.

The majority of contributions to World War literature by American officers, particularly those of higher rank, have been marred by efforts to prove some phase of a controversial point. But not so this little volume. It is written in that forceful style for which General Bullard is noted, and is a story of American participation in battle. It is not a critical military study. It is not a cold account of tactical operations. It is a story of action, human, vibrant, and engrossing.

Opening the story with a discussion of the question as to our tardiness in entering the war and a description of the military situation of the Allies in 1917, General Bullard pictures the creation of the American Army, the fight General Pershing made to prevent the United States forces from being frittered away in replacements to the British and French sadly depleted battalions, and the unswerving support given by President Wilson and Secretary Baker to General Pershing in his stand.

He then describes in a fascinating manner the American effort at Cantigny, Chateau-Thierry, the Champagne, Soissons, the St. Mihiel salient and the Meuse-Argonne. While this account deals primarily with the American effort, there is no hesitancy in commenting upon the Allies' activities. And sometimes these comments do not picture the French and British as the infallible generals and superb soldiers some authors would have us believe.

In his preface, General Bullard says this book was written nearly five years ago and that probably the delay in publication was fortunate. Maybe so, but I know of no book on our part in the war that I have read with such avidity. At any rate, its publication is appropriate now. With war clouds again hanging over Europe and discussions going on as to our conduct in the coming war, it is very pertinent to review some of the raw facts about our participation in the last war. R. M.

FROM A SURGEON'S JOURNAL. By Harvey Cushing, M. D. Boston: Little, Brown, and Company. 1936. $5.00.

DOCTOR CUSHING went to France in 1915 with the Harvard Unit in the American Ambulance at Neuilly. Later he returned to the United States and set about organizing a base hospital unit as part of the preparedness movement which was gaining impetus during the latter part of 1916. In May of the next year he set off again for the Western Front, this time with Base Hospital Number Five, and thenceforth his service was with the British until at the end of some thirteen months he was assigned to the Medical Headquarters of the A. E. F. as senior consultant in neurosurgery. His experiences behind the lines of three armies reflect an aspect of war that is usually neglected by writers on military subjects. How many military failures have been caused, or at least augmented, by insufficient medical facilities?

Colonel (or perhaps he prefers the title of Doctor) Cushing's diary reveals much that might have been improved upon in the American First Army. Obviously his almost daily notes are of interest primarily to his own profession, but the comments of a

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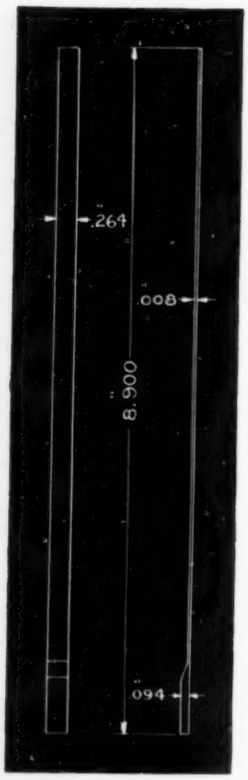

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scientific man placed in position to observe at first-hand the jetsam of battle cannot be dismissed because of the prevalence of polysyllabic adjectives. He recounts the gossip of the back areas, the remarks of wounded soldiers, the thousand minor happenings of every variety that accumulate into the collective experience of an army. After reading the book there can be no doubt that the author's long and intimate association with suffering humanity has impressed him with the fundamental nobility of mankind. Consciously or unconsciously he is inclined to compare our Army with the British. On such occasions our inexperience in warfare becomes evident; there was not time enough for us to become soldiers in the 1918 sense of the word. At the end, in discussing the undisciplined conduct of a homeward bound regiment, he is led to wonder if the absence of this sort of thing among the British indicated that the quality of British leadership was superior to ours. It is a reflection that has an important bearing upon our military philosophy and might warrant some objective study. Doctor Cushing's contacts with officers of the Regular Army seem to have left him with an unfortunate impression which it is hoped that the years have modified. At the same time, the Regular Army might well take to heart his critical remarks for they reflect the point of view of the type of mature citizen who in the future must help us to wage war. The author's industry as a diarist is astonishing; the editor of this work reports that the complete journal, including maps and orders, fills nine bound volumes. Perhaps it is not out of place here to compliment this un-named editor upon the discrimination with which the present book was compiled. There are a number of excellent illustrations including maps of the important battles. Briefly, the book is most unusual and an important contribution to the literature of war. J. M. E.

The Conquest of Constantinople. Translated from the old French of Robert of Clari. By Edgar Holmes McNeal. New York: Columbia University Press. 1936. $2.75.

This is the latest title of the "Records of Civilization" series which is edited under the auspices of the Department of History of Columbia University. Robert of Clari took part in the Fourth Crusade and upon his return home, like many another honest soldier, he dictated the story of the campaign. In his own final words: "And though it may be he has not told the conquest as finely as many a good teller would have told it, none the less he has told the very truth, and there are so many true things that he cannot remember them all". It is a brief narrative of a modest man of his time, valuable to the historian who seeks to corroborate the statements of more pretentious writers, and interesting as the simple tale of a romantic event. The Crusaders after having assembled at Venice to embark for the Holy Land, found themselves in such financial straits that they could not go on with the enterprise. The suggestion of the Doge of Venice that they recoup their funds at the expense of Constantinople was accepted by the leaders, and that golden remnant of the Empire of Rome was at last conquered. By that time, however, the holy object of the expedition had been forgotten, and Robert of Clari returned to Cléry-lez-Pernois in 1205, if not a poorer at least a wiser man. Perhaps Robert is unique as a recorder of military events in which he took an active part,—unique in that he mentions himself but once. It is not because of this fact alone that the book is recommended, but in addition it has a naïve charm that is most refreshing.

Several passages revealing the methods of transporting troops by sea and of employing them in a siege are of particular interest. This was the period in European warfare when practically the only disciplined bodies of men were the military orders such as the Knights Templar. A few years later the hordes of Ghengis Khan reached Bohemia with nothing between them and the Atlantic but raw feudal levies. Happily for Europe the Khan's armies were recalled upon the news of his death. J. M. E.

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NEWLY ELECTED OFFICIALS OF THE ARMY ORDNANCE ASSOCIATION

At the biennial election of Officers and Directors, held September 1, 1936, the offices of President, two Vice-Presidents and three National Directors were filled. Top row (left to right): Col. William W. Coleman, Vice-President; Brig. Gen. Benedict Crowell, President; Col. Frederick H. Payne, Vice-President. These officers will serve for two years beginning January 1, 1937. Colonel Payne succeeds the late Col. William C. Spruance. Directors elected for four years, 1937 to 1940 (bottom row, left to right): Col. Robert P. Lamont, Col. Frank A. Scott and Col. Charles L. Harrison. (See page 172.)